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ELECTRONICS CO.

PULSE GENERATOR
MODEL B7B

CULVER CITY,
CALIFORNIA

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PULSE GENERATOR

MODEL B7B

GENERAL DESCRIPTION

The model B7B is a compact, lightweight, gen-l purpose pulse generator designed to meet rigid requirements of a great number of re-rch and test applications. Exacting de-n criteria, an electron tube complement of a ll number of tube types, and special duty cy- limiting circuitry to automatically protect output tubes from life-shortening overloads ure long periods of reliable operation with a imum of maintenance and repair problems.

The model B7B produces trains of 50 volt ses having repetition rates to 2 megacycles, se delays and widths to 10,000 microseconds, e and fall times of 15 millimicroseconds, and ermissible duty factor of up to 30% at full litude.

The model B7B generates these pulse trains in the following manner. (Refer to Fig. A for time relations of the various pulses.)

The oscillator section creates a continuous train of timing pulses to establish the repetition rate of the output pulse. These timing pulses are used to start delay circuitry to produce what we shall call a start pulse. The start pulse occurs at the end of a time predetermined by the pulse delay controls. The start pulse is used to form the leading edge of the output pulse and to start another delay circuit which produces a second pulse called the stop pulse. This stop pulse occurs at the end of a time predetermined by the setting of the pulse width controls and is used to form the trailing edge of the output pulse. A clamp tube, which is cut off at the time the start pulse occurs, and back on again when the stop pulse occurs, creates what is used as a fill-in pulse between the start and stop pulses. The basic output pulse is therefore created by turning the main pulse on with the start pulse, keeping it on with the fill-in pulse, and turning it off with the stop pulse.

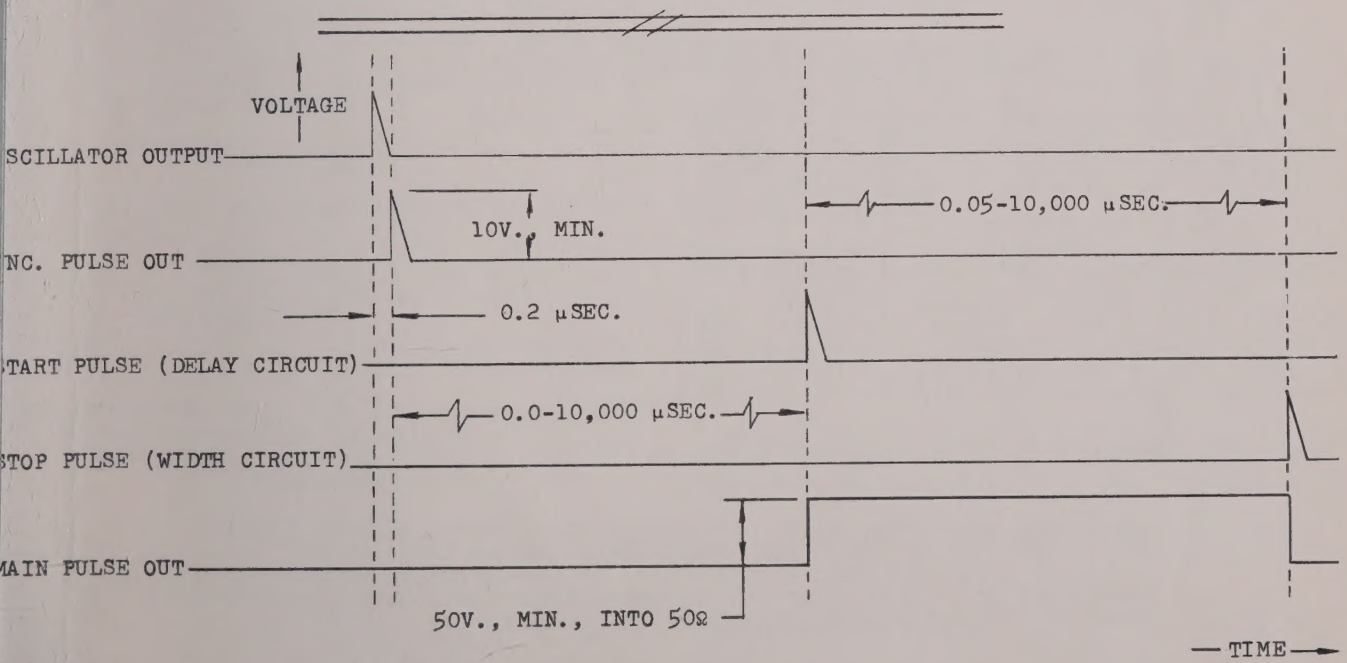


FIG. A TIMING DIAGRAM

The pulse forming circuitry then amplifies the power of this pulse and presents it through suitable attenuation and polarity determining circuitry as the main output pulse.

Supplementary circuitry furnishes a synchronizing pulse from the oscillator section for use in synchronizing additional instrumentation with the main output pulse of the generator, a means of triggering the generator from a external source so that it may be synchronized with other instruments, and a means of varying the rise and fall times of the output pulse for applications requiring a degraded pulse shape.

Past experience has indicated confusion concerning the definition of some of the basic terminology used in reference to pulses. Fig. B shows these terms as defined by accepted IRE standard pulse terminology. When used in this manual, these terms are meant to be as defined by this standard.

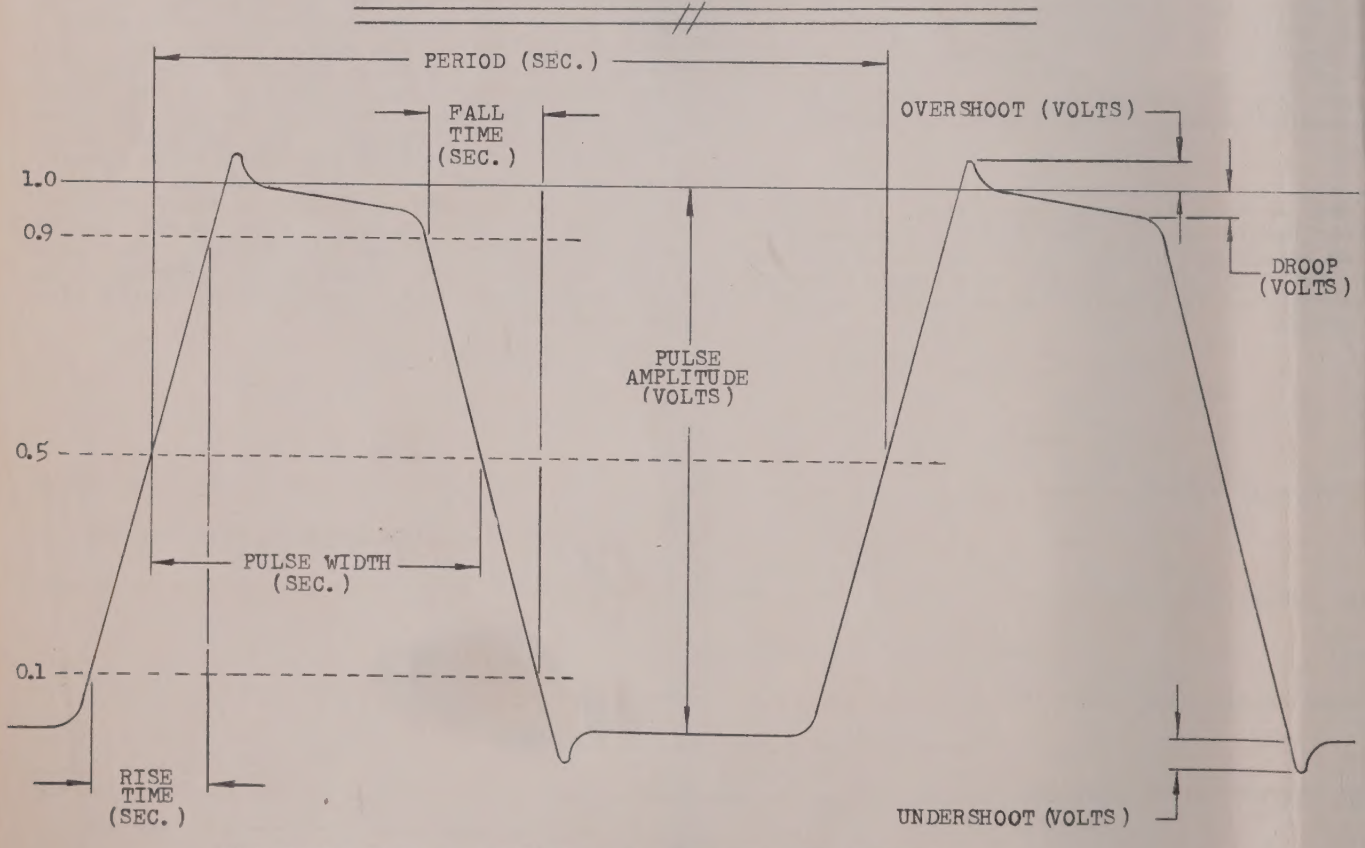
SPECIFICATIONS

The following are the design specification of the model B7B pulse generator. The instrument will, in most cases, exhibit properties which are superior to the specifications.

OSCILLATOR REPETITION RATE

The internal oscillator is continuously variable from 20 cycles per second to 2 megacycles per second in five ranges.

20 cps	-	200 cps
200 cps	-	2 kc
2 kc	-	20 kc
20 kc	-	200 kc
200 kc	-	2 mc



REPETITION RATE (PULSES/SEC.) = 1/PERIOD (SEC./PULSE)
DUTY FACTOR (%) = PULSE WIDTH (SEC.)/PERIOD (SEC.) 100
OVERSHOOT (%) = OVERSHOOT (VOLTS)/PULSE AMPLITUDE (VOLTS) 100
UNDERSHOOT (%) = UNDERSHOOT (VOLTS)/PULSE AMPLITUDE (VOLTS) 100
DROOP (%) = DROOP (VOLTS)/PULSE AMPLITUDE (VOLTS) 100

FIG. B DEFINITIONS OF BASIC PULSE TERMINOLOGY

PULSE DELAY

Main pulse delay is continuously variable, th respect to the sync. pulse out, from 0.0 roseconds to 10,000 microseconds in five nges.

0.0 µsec.	-	1.0 µsec.
1.0 µsec.	-	10 µsec.
10 µsec.	-	100 µsec.
100 µsec.	-	1,000 µsec.
1,000 µsec.	-	10,000 µsec.

PULSE WIDTH

Main pulse width is continuously variable om 0.05 microseconds to 10,000 microseconds in ve ranges.

0.05 µsec.	-	1.0 µsec.
1.0 µsec.	-	10 µsec.
10 µsec.	-	100 µsec.
100 µsec.	-	1,000 µsec.
1,000 µsec.	-	10,000 µsec.

TRIGGER REQUIRED

To trigger the unit from an external source, e following trigger pulse is required.

PLITUDE	20V., minimum.
PETITION RATE	2 mc, maximum.
SE TIME	1.0 µsec. or less.
LARITY	Positive or negative.

TE: At lower repetition rates and/or faster rise times, the instrument triggers with a much lower amplitude pulse. The fast rise time quality of the sync. pulse out allows the model B7B to be triggered from the sync. pulse from another model B7B at all repetition rates.

MAIN PULSE

The following are the specifications of the ain output pulse.

MPLITUDE	50V., minimum, into a 50Ω load.
OLARITY	Positive or negative, but not simultaneously.
ISE TIME	0.015 microseconds.
ALL TIME	0.015 microseconds.

OTE: Both rise and fall time may be degraded simultaneously to approximately one (1) microsecond.

SYNC PULSE OUT

The following sync. pulse is available at a ront panel connector.

MPLITUDE	10V., minimum.
IDTH	0.05 µsec., minimum.
ISE TIME	0.03 µsec., maximum.
OLARITY	Positive.

OVERSHOOT AND UNDERSHOOT	5%, maximum, except when pulse is attenuated more than 30db. with the 10db. step attenuator. 30%, maximum, at 50db. down.

DROOP:

0-100 µsec. wide pulse	Negligible.
100-1,000 µsec. wide pulse	15%, maximum.
1,000-10,000 µsec. wide pulse	25%, maximum.

DUTY FACTOR	30%, maximum, at full amplitude.
ATTENUATION	0 to 60db., continuously variable.
OUTPUT IMPEDANCE	50Ω.

MISCELLANEOUS SPECIFICATIONS

The following are miscellaneous specifications of the instrument.

POWER REQUIRED	115V., 3.26 amps., 50-60 cps, 375 watts.
VENTILATION	Forced air.
DIMENSIONS	8 3/4" X 19 1/2" X 13".
WEIGHT, NET	42 lbs.
WEIGHT, SHIPPING	56 lbs.
ACCESSORIES INCLUDED	One instruction manual.

OPERATING INSTRUCTIONS

Refer to Fig. C for the location of all of the front panel controls described below.

FREQUENCY RANGE SWITCH When operated in the internal oscillator positions rotary switch S110 switches timing capacitors C110 through C119 in the grid circuits of V11 to determine the frequency range of the oscillator. In the external trigger position, the switch applies the external trigger pulse to the grid of the Schmitt trigger tube, V12.

FINE FREQUENCY AND TRIGGER SENSITIVITY CONTROL Potentiometer R115 varies the voltage at the grid of V11 to determine the repetition rate of the oscillator on any of the frequency ranges. During periods of external trigger operation this potentiometer becomes the trigger sensitivity control to determine the triggering level.

EXTERNAL TRIGGER POLARITY SWITCH In the two external trigger positions, positive or negative, depending on the polarity of the input signal, the switch selects the positive pulse from the external trigger tube, V10A, and transfers it through S110 to the input of the Schmitt trigger tube, V12.

DELAY RANGE SWITCH Rotary switch S200 switches timing capacitors C200 through C204 in the grid to ground circuit of V20A to determine the range of pulse delay.

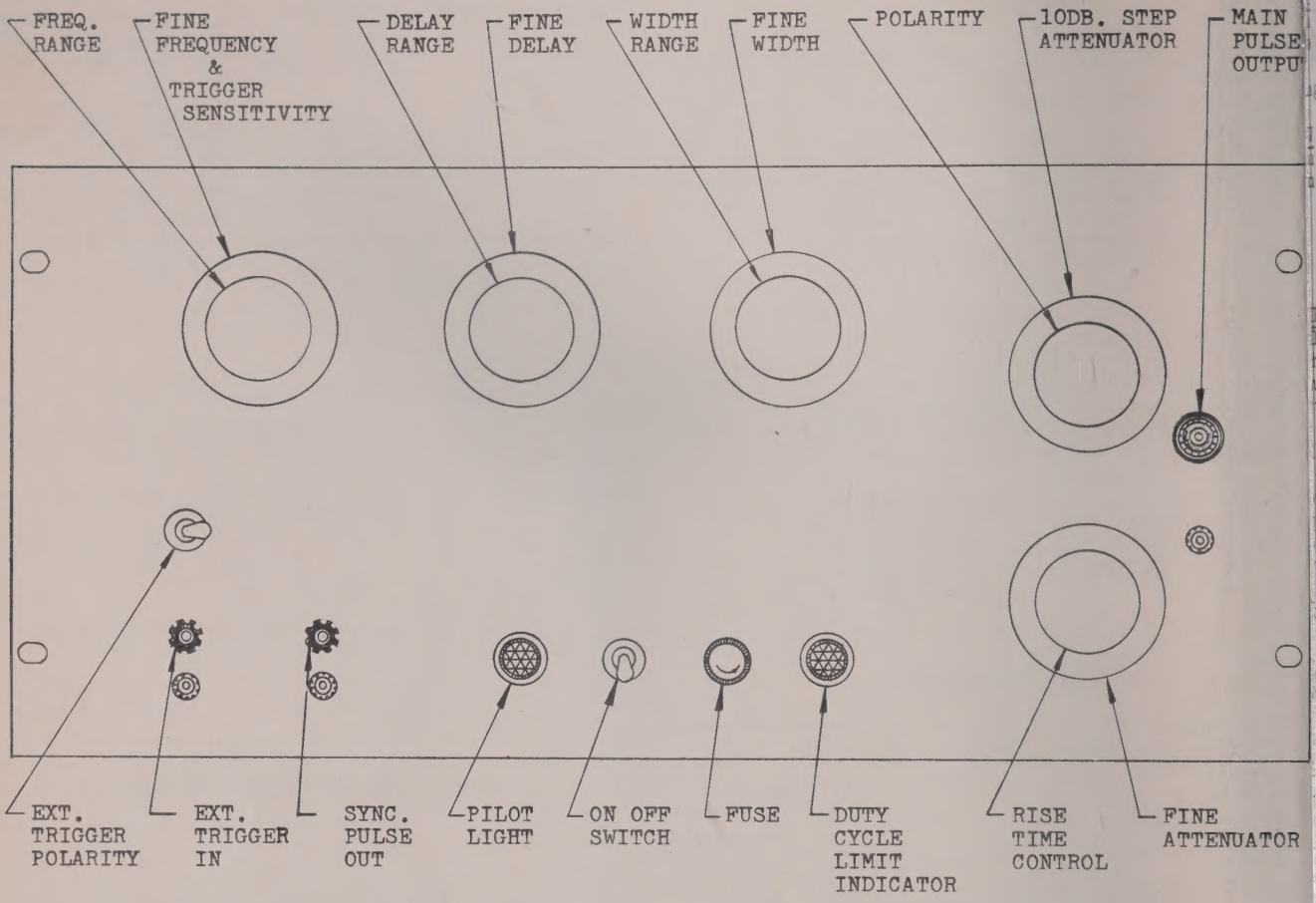


FIG. C FRONT PANEL CONTROLS

FINE DELAY CONTROL Potentiometer R208 varies the cathode to ground resistance of the pulse delay multivibrator, affording continuous delay settings on all delay ranges.

WIDTH RANGE SWITCH Rotary switch S300 switches timing capacitors C300 through C304 in the grid to ground circuit of V30A to determine the range of pulse width.

FINE WIDTH CONTROL Potentiometer R308 varies the cathode to ground resistance of the pulse width multivibrator, affording continuous width settings on all width ranges.

10db. STEP ATTENUATOR Rotary switch S800 controls the amplitude of the output pulse in 10db. steps.

FINE ATTENUATOR CONTROL Potentiometer R531 affords a continuously variable attenuation through each range of the 10db. step attenuator.

POLARITY SWITCH Rotary switch S450 determines the polarity of the output pulse by grounding various levels of the floating power supply a applying its voltages to the output tubes.

RISE TIME CONTROL Potentiometer R401 varies t resistance in the output tube control grid ci cuits, affording simultaneous degradation rise and fall times to approximately one micr second.

EXTERNAL TRIGGER IN J100 couples an extern trigger through C100 to the control grid of t external trigger amplifier, V10A.

SYNC. PULSE OUT J101 takes the synchronizi pulse from the cathode of the sync. pulse cath ode follower, V10B.

PILOT LIGHT Lamp DS500 lights when 115V. A 50-60 cps, single phase power is applied to th power transformer, T500.

ON-OFF SWITCH Switch S500 applies power to th primary winding of the power transformer, T500.

FUSE 4 ampere "slo-blo" fuse F500 protects th pulse generator from overloads.

CYCLE LIMITING INDICATOR Lamp DS530 lights the 30% duty factor limitation is exceeded. lamp, when lit, is a warning to the operathat the amplitude of the output pulse is g automatically reduced.

PULSE OUT Coaxial connector J800 takes the pulse from the output of the 10db. step atator.

PRELIMINARY INSTRUCTIONS

ILATION The model B7B pulse generator is ed by forced air. It is imperative that ends of the instrument be kept free of obctions at all times in order to insure adee air flow.

t is inadvisable to operate the instrument appreciable lengths of time with the dust rs removed. These covers not only help to the instrument free from dust and other ign matter, but also properly direct the of air through the instrument. Therefore, he end covers are removed and the instrument ted in a rack, the dust cover sections must eplaced before rack mounting.

FACTOR LIMITATION The dissipation limitais of the 6DQ5 power amplifier tubes limit duty factor of the model B7B pulse generator 30%, i.e., at full pulse amplitude, the pulse th must never equal greater than 30% of the se to pulse spacing. Operation up to approxtely 70% duty factor is possible with reduced se amplitude.

The 30% duty factor limitation is automatily controlled in the model B7B. Should the y factor limitation be exceeded, the model automatically reduces the amplitude of the put pulse to such a level that the ratings of output tubes are not exceeded. When the ducycle limiter is in operation, the duty cycle p on the front panel lights, warning the optor of the reduced pulse amplitude condition.

ST TIME OPERATION The following procedure is ommended for putting the instrument into option for the first time.

1. Turn the power switch to "OFF" and connect the line cord to a source of 115V., 50-60 cps power.

2. Set the instrument controls as follows:

a.	Frequency Range	200 kc
b.	Frequency	100 kc
c.	Delay Range	1 µsec.
d.	Delay	0 µsec.
e.	Width Range	10 µsec.
f.	Width	1 µsec.
g.	10db. Step Attenuator	0 db.
h.	Fine Attenuator	0 db.
i.	Polarity	"+"
j.	Rise Time	clockwise

3. Connect a synchroscope as follows:

a.	Sweep	1 µsec./cm
b.	Vertical Deflection	20 V./cm
c.	Trigger	External from the sync. out connector on the model B7B front panel.

4. Connect a ground strap from one of the model B7B ground binding posts to a ground binding post on the synchroscope.

5. Connect a 50Ω resistive load between the pulse out connector and ground. The output impedance of the model B7B is 50Ω and it is imperative that it be properly terminated if the true output waveform is to be observed.

6. Connect the input probe of the synchroscope across the 50Ω external load. If the true waveform of the output pulse is to be observed, it is imperative that the synchroscope input probe be properly compensated for viewing step function waveforms by adjusting the compensating capacitor in the probe itself and that the probe ground strap be connected to the instrument ground.

7. Turn the model B7B power switch to "ON" and allow approximately one (1) minute for the instrument to reach operating temperature. Adjust the trigger sensitivity of the synchroscope for a stable trace. The model B7B controls may now be set to any desired values within the 30% duty factor limitation.

MAINTENANCE INSTRUCTIONS

DANGER

The power supplies in this instrument operate at voltages which are dangerous to personnel. Extreme caution must be exercised at all times. Repair or maintenance work should never be attempted unless competent personnel, thoroughly trained in the accepted methods of artificial respiration, are in attendance.

DANGER

The following maintenance suggestions are designed to aid the maintenance technician in scheduling regular preventative as well as cor-

rective maintenance routines. It is important that maintenance routines be performed regularly to obtain maximum life and usefullness from the instrument.

FAN MOTOR The fan motor bearings require oil periodically. Use a good grade of light machine oil and apply only a drop or two every six months.

CLEANING THE INSTRUMENT At regular intervals, any dust that has settled on the interior of the instrument should be removed by means of dry compressed air. AVOID high velocity air streams which might injure the instrument or disturb adjustments. Persistent dirt may be removed with a lint-free cloth and, if necessary, carbon tetrachloride.

Under normal conditions, the silver plated contacts of the rotary switches should not require special attention. In case they become tarnished, the contacts should be cleaned by rotating the switch several times.

INSPECTION A visual inspection for loose or broken wiring, loose hardware, and discolored or deformed components is desirable while the instrument is being cleaned.

SWITCHES Turn the rotary switches while observing the contacts to check contact centering in each index position. Improperly centered contacts may be due to the switch becoming warped or twisted. AVOID pressure on the contacts as they are easily damaged.

CAPACITORS AND RESISTORS Inspect the electrolytic capacitors for leakage of electrolyte. Replace if necessary. The wax coating of the paper tubular capacitors may drip if the instrument has been overheated by operation in a restricted space. This condition usually does not indicate replacement.

Composition resistors should be checked for serious discoloration which would indicate excessive dissipation and, therefore, faulty operation. A moderate amount of discoloration is normal.

RACK MOUNTING The model B7B, as purchased, is a portable instrument. It may, however, be mounted in a rack with other instrumentation by removing the louvered end panels. To remove the end panels, first remove both sections of the dust cover. The six sheet metal screws which hold each louvered end panel to the inner end panels are now accessible. Remove these screws and the two screws which hold each end panel to the front panel. Replace both dust covers on the instrument and it is ready for rack mounting. The dust covers must be put back on the instrument before rack mounting as they not only serve to keep dust and other foreign matter out of the instrument, but also help to properly direct the flow of cooling air through the instrument.

CALIBRATION The model B7B contains several controls for the purposes of calibration, pulse shape adjustment, etc. These controls are preset at the factory and should not require readjustment except due to component aging or when electron tubes are replaced.

When readjustment of these controls becomes necessary, the instrument should be allowed to operate for one hour prior to adjustment in order that all components may reach their normal operating temperatures and the instrument has reached maximum stability.

The calibration and checkout chart shown on the following page is patterned after the checkout procedure used at the factory. The chart is intended as a calibration aid only and presupposes that the instrument is in proper working order, except for calibration. It should be noted that there is some interaction between many of the controls. Therefore, it is recommended that the complete calibration and check procedure, working from top to bottom of the chart, be performed at one time on a periodic basis rather than spot adjustments to one circuit which could conceivably have adverse effect on another. Note that an asterisk (*) in any one column indicates that it does not matter which position that control is in for that particular check.

All of the controls used for calibration and adjustment are called out by schematic symbol number on the chassis or circuit board on which they are located, with the following exceptions:

C118 is mounted on the repetition rate switch.

C204 is mounted on the delay switch.

C304 is mounted on the width switch.

R602 is adjustable through the access hole at the rear of the instrument.

TROUBLE SHOOTING It is of extreme importance that the operation, theory, and physical location of components be thoroughly understood before any repair of the instrument is undertaken. A careful study of the circuit descriptions and the schematic diagram will, in most instances, indicate the cause for a particular difficulty in a much shorter time than will a blind point to point check of the entire instrument. It is also suggested that whenever an operational difficulty is encountered, a recheck of the setting and adjustment of the operational controls will often times reveal that a control has been inadvertantly set in the wrong position and that this is the cause of the difficulty.

ELECTRON TUBE FAILURE A major cause of equipment failure is weak or inoperative electron tubes. When a system failure has been traced to a particular circuit, it will be found expedient to test the electron tubes in that circuit, replacing all weak or inoperative ones, before a more detailed examination of the circuit is un-

TO CHECK OR CALIBRATE			MODEL B7B DIAL SETTINGS											OSCILLOSCOPE SETTINGS		OBSERVE	ADJUST	REMARKS
			REP. RATE		DELAY		WIDTH		ATTENUATOR		POLARITY		RISE TIME					
			RANGE	VERNIER	RANGE	VERNIER	RANGE	VERNIER	STEP	VERNIER	OUTPUT	TRIGGER	CONTROL	VERTICAL	HORIZONTAL			(*) + or -
REP. RATE	20~-200~ 200 -2KC 2KC-20KC 20KC-200KC	HIGH END	200~-2KC	20	1	1	10	5	0	CW	*	*	CW	20V/cm	0.1millisec/cm	0.5 millisec Pulse to pulse	R111	There is some interaction between the high and low controls. Therefore, these two adjustments should be readjusted several times until both are correct. Adjustment of this range automatically adjusts the other three ranges.
		LOW END	200~-2KC	2	1	1	100	5	0	CW	*	*	CW	20V/cm	1 millisec/cm	5 millisec Pulse to pulse	R114	
	200KC-2MC		200KC-2MC	20	1	MIN	1	MIN	0	CW	*	*	CW	20V/cm	0.1μsec/cm	0.5μsec Pulse to pulse	C118	This adjustment is to be made only after the four lower ranges have been calibrated.
	EXTERNAL TRIGGER	POSITIVE	EXT. TRIG.	SEE REMARKS	1	MIN	SEE REMARKS		0	CW	*	+	CW	20V/cm	SEE REMARKS	One output pulse for each trigger in.	NONE	Use any input trigger from 20~ to 2MC rep. rate, 20V amplitude, and rise time less than 1μsec. Oscilloscope horizontal settings and B7B width setting will depend on rep. rate. Adjust B7B rep. rate vernier for reliable triggering.
		NEGATIVE	EXT. TRIG.	SEE REMARKS	1	MIN	SEE REMARKS		0	CW	*	-	CW	20V/cm	SEE REMARKS	One output pulse for each trigger in.	NONE	
	SYNC PULSE	AMPLITUDE	200KC-2MC	20	1	MIN	1	MIN	0	CW	*	*	CW	10V/cm	0.1μsec/cm	10V, Minimum	NONE	Looking at pulse at the sync. out jack on the instrument front panel. Polarity of the sync. pulse is positive.
		WIDTH														Approx .05μsec		
		RISE TIME														Approx .03μsec		
PULSE DELAY	1-10 10-100 100-1,000 1,000-10,000		2KC-20KC	2	10	10	1	10	0	CW	*	*	CW	20V/cm	1μsec/cm	10μsec. - leading edge of sync pulse to leading edge of output pulse.	R200	Adjustment of this range also adjusts the three remaining longer ranges.
	0 to 1		20KC-200KC	2	1	10	1	MIN	0	CW	*	*	CW	20V/cm	0.1μsec/cm	1μsec. - leading edge of sync pulse to leading edge of output pulse.	C204	This adjustment is to be made only after the four longer ranges have been calibrated. Note that when the delay vernier is CCW the output pulse occurs coincident with or before the sync. pulse.
PULSE WIDTH	1-10 10-100 100-1,000 1,000-10,000		2KC-20KC	2	1	MIN	10	10	0	CW	*	*	CW	20V/cm	1μsec/cm	10μsec. - leading edge to trailing edge of output pulse at 50% amplitude points.	R300	Adjustment of this range also adjusts the three remaining longer ranges.
	0.05 to 1		20KC-200KC	2	1	MIN	1	10	0	CW	*	*	CW	20V/cm	0.1μsec/cm	1μsec. - leading edge to trailing edge of output pulse at 50% amplitude points.	C304	This adjustment to be made only after the four longer ranges have been calibrated. Note that when the width vernier is CCW the pulse width is 0.05μsec. or less.
OUTPUT PULSE	AMPLITUDE	POSITIVE NEGATIVE	20~-200~	2	1	MIN	10,000	8	0	CW	+	*	CW	20V/cm	1 millisec/cm	SEE REMARKS	R473	Increase the adjustment until the amplitude of the output pulse near the trailing edge stops increasing and the leading edge starts to peak. Decrease the adjustment until the peaking just disappears.
	PULSE SHAPE	SHORT PULSE	20KC-200KC	2	1	MIN	1	5	0	CW	+	*	CW	20V/cm	0.1μsec/cm	SEE REMARKS	C260 C360 C472	Set C472 for best possible overall pulse shape. Adjust C260 and C360 for improvement. Finally, slight readjustment of all three controls will optimize the pulse shape.
		LONG PULSE	2KC-20KC	2	1	MIN	10	10	0	CW	+	*	CW	20V/cm	10μsec/cm	SEE REMARKS	C350 R354	Adjust R354 for minimum droop. Adjust C350 for optimum flatness of pulse top. Finally, slight readjustment of both controls will optimize long pulse shape.
	ATTENUATOR	10db STEP	2KC-20KC	2	1	MIN	10	10	0	CW	+	*	CW	SEE REMARKS	1μsec/cm	SEE REMARKS	NONE	The step attenuator dial should be rotated to the various dial settings while noting that pulse amplitude decreases accordingly. Change the oscilloscope vertical setting as the attenuator is changed. At high attenuation settings, good grounding between instrument and oscilloscope becomes extremely important.
		VERNIER	2KC-20KC	2	1	MIN	10	10	0	SEE REMARKS	+	*	CW	20V/cm	1μsec/cm	SEE REMARKS	SEE REMARKS	Turn attenuator vernier CCW until the output pulse decreases 10db. Pulse flatness is pre-adjusted at the factory at this setting with R353. Note, however, that R353 may be adjusted for optimum flatness at any fine attenuator (0 to 10db down) or pulse width setting. Recheck the R354 setting.
	DUTY FACTOR		20KC-200KC	10	1	MIN	10	3	0	CW	+	*	CW	20V/cm	1μsec/cm	SEE REMARKS	R602	Adjust R602 to the point that pulse amplitude just starts to decrease and the duty cycle lamp on the front panel lights.
	RISE TIME	FASTEST	20KC-200KC	2	1	MIN	1	MIN	0	CW	+	*	CW	20V/cm	0.02μsec/cm	0.015μsec or less	NONE	Rise and fall times will appear to be greater than 0.015μsec. when viewed on an inferior oscilloscope. The Tektronix type N sampling unit is recommended for direct viewing of actual rise and fall times.
		DEGRADED	20KC-200KC	2			10	5					CCW		1μsec/cm	Approx 1μsec		
	FALL TIME	FASTEST	20KC-200KC	2	1	MIN	1	MIN	0	CW	+	*	CW	20V/cm	0.02μsec/cm	0.015μsec or less	NONE	
		DEGRADED	20KC-200KC	2			10	5					CCW		1μsec/cm	Approx 1μsec		
	POLARITY	ALL OUTPUT PULSE CHARACTERISTICS SHOULD BE RECHECKED WITH THE POLARITY SWITCH IN THE "-" POSITION																

CALIBRATION AND CHECK CHART MODEL B7B

dertaken. A HICKOCK #539A Tube Checker has been found very satisfactory in detecting electron tubes with low transconductance.

ISOLATION OF THE DEFECTIVE CIRCUIT The following trouble shooting procedure is designed to isolate the trouble to one particular circuit.

Complete failure of the instrument to operate indicates a power source difficulty. Check the source of power and make certain that the power cord plug is firmly in place. Check the fuse on the instrument front panel. A blown fuse indicates an overload condition within the instrument. Blown fuses should not be indiscriminately replaced without first ascertaining the cause of overload, as further damage is likely to result.

If power is applied to the instrument but it still fails to operate, a check should be made of the power supply voltages. For this and subsequent checks, it will be necessary to remove the dust covers from the instrument.

It will be necessary to use a synchroscope for further checks. It is important that a synchroscope with a wide band-pass be used as it is impossible to observe many of the fast rise times and narrow pulse widths on an inferior synchroscope. The Tektronix models 517, 541, 543, or 545 have been found satisfactory in observing the waveforms present in the instrument.

If the instrument has no output pulse, check for a sync. pulse at the sync. out jack on the instrument front panel. If there is no sync. pulse, the trouble is in the oscillator section of the instrument. If, however, a sync. pulse is present, synchronize a synchroscope with this pulse and proceed as follows.

Check for a pulse at the input of the attenuator switch, S800. A pulse here isolates the trouble to the switch or its components. If no pulse or a deformed pulse is present, check for a pulse at pins 3 and 6 of V40. If a normal pulse is present at this point, the faulty circuitry is in the output section.

If no pulse is present at the cathodes of V40, the trouble will probably be found in the delay multivibrator or blocking oscillator. If, however, a deformed pulse is present, a study of its shape will be helpful in quickly finding its cause.

If the deformed pulse shows a very slow rise time and normal fall time, the start pulse is missing. Check the start pulse channel. If there are very narrow pulses where the leading and trailing edges of the output pulse would normally be, the clamp circuit is inoperative. If the pulse rises normally and then immediately starts to decay slowly toward zero, the trouble lies in the clamp circuit or the width multivibrator circuit. Finally, if the pulse is normal except for a slow fall time, check the stop pulse channel for faulty operation.

In checking each subsection, it is advisabl to start by looking for an output pulse from th section and then work back toward the start o the section. Thus, whenever a normal pulse i found, the trouble is isolated to the stag which immediately follows it.

CIRCUIT DESCRIPTION

OSCILLATOR SECTION The oscillator section consists of the external trigger amplifier, V10A the free-running multivibrator, V11; th Schmitt trigger, V12; the repetition rat blocking oscillator, V13; and the sync. puls cathode follower, V10B. V10, V11, V12, and V1 are type 6DJ8 dual triode electron tubes.

The repetition rate of the free-running multivibrator is determined by the action of tw front panel controls. The range of the oscilla tor is determined by the selection of timing capacitors C110 through C119, in the grid circuit of V11, by the oscillator range switch, S110. Fine repetition rate control of the multivibrator, through any range, is determined by varying the fine frequency potentiometer, R115, whic varies the voltage to this grid circuit.

The limits of repetition rate for each range are set with the two calibration potentiometers, R111 and R116, which establish the range through which this voltage may vary.

The output, taken from the plate of the multivibrator triggers the Schmitt trigger circuit. The Schmitt trigger circuit shapes the pulse and sends it to the repetition rate blocking oscillator.

The repetition rate blocking oscillator again shapes the pulse. The basic repetition rate timing pulse is taken from the cathode of this blocking oscillator and is used to trigger the delay multivibrator.

The external trigger amplifier provides a means of triggering the instrument from an external source. The external trigger polarity switch, in either the positive or negative position, depending on the polarity of the input signal, couples the positive pulse from V10A through the repetition rate range switch, S110, to the input grid of the Schmitt trigger. Potentiometer R115 now becomes a trigger sensitivity control to set the triggering level. It should be noted that the repetition rate switch, S110, must be placed in the external trigger position in order to trigger the model B7B from an external source.

The timing pulse taken from the cathode of the repetition rate blocking oscillator is also coupled through a 0.2 μsec. delay line to the

d of the sync. pulse cathode follower. The se taken from the cathode is brought to the trument front panel to be used as a synchro- ing pulse for use with other instrumentation. to the fact that the sync. pulse occurs ap- ximately 0.2 μsec. after the pulse which iggers the pulse delay circuit, we are able to ercome the inherent delay of the remaining cuitry and can thus produce output pulses ich are not delayed in time with respect to sync. pulse.

LAY SECTION The delay section consists of the lay multivibrator, V20, and the delay blocking cillator, V21. V20 is a type 6DJ8 dual triode ctron tube and V21 is a type 6BQ7A dual tri- e electron tube.

The monostable multivibrator, V20, is trig- red from its stable state to its quasi-stable ate by positive pulses from the oscillator ction which are coupled into the grid of V20B d the plate of V20A through diode CR201. The ngth of time which the multivibrator remains this quasi-stable state, determined by the ming capacitor in the grid circuit of V20A and e cathode to ground resistance of V20, is the lay time of the circuit. Thus, this circuit termines the time between the oscillator sec- on timing pulse and the start of the main lse.

The range of delay is determined by the se- ction of timing capacitors C200 through C204 the delay range switch, S200. Fine delay ntrol throughout any range is determined by rying the cathode to ground resistance with e fine delay potentiometer, R208.

R200 sets the voltage to which the grid cir- it is returned, thus providing calibration for e various ranges.

A pulse, created by the return of the multi- brator to its stable state after this prede- rmined delay, is coupled from the plate of 0B to trigger the delay blocking oscillator, 1.

The pulse taken from the cathode of the ocking oscillator is known as the "start lse". This start pulse goes to the amplifiers the start channel and to the width section ere it is used to trigger the width multivi- ator.

IDTH SECTION The pulse width section consists the width multivibrator, V30. V30 is a type J8 dual triode electron tube.

The monostable multivibrator, V30, is trig- red from its stable state to its quasi-stable ate by positive pulses from the delay section ich are coupled into the grid of V30B and the ate of V30A through diode CR301. The length time which the multivibrator remains in this asi-stable state, determined by the timing ca- acitor in the grid circuit of V30A and the athode to ground resistance of V30, is the delay time of this circuit. Thus, this circuit determined the time between the delay section output pulse which starts the main pulse and the width section output pulse which stops the main pulse.

The range of pulse width, is determined by the selection of timing capacitors C300 through C304 by the width range switch, S300. Fine width control throughout any range is determined by varying the cathode to ground resistance with the fine width potentiometer, R308.

R300 sets the voltage to which the grid circuit is returned, thus providing calibration for the various ranges.

Two outputs are taken from the width multivibrator. The first is the waveform taken from the plate circuit of V30B. This waveform is a negative going pulse equal in time duration to the delay time of the width multivibrator. It is coupled through C310 to the grid of the clamp tube, V35B. The second output, a pulse created by the return of the multivibrator to its stable state after the predetermined delay, is known as the "stop pulse". This stop pulse is coupled into the amplifiers in the stop channel.

START PULSE CHANNEL The start pulse channel consists of three pulse shaping amplifier stages and the leading edge forming tube. V25 and V26 are type 7119 dual triode electron tubes. V27 is a type 6BQ7A dual triode electron tube.

The start channel receives the positive start pulse from the delay section through a 0.02 microsecond delay line, DL210. This delay line delays the start pulse without delaying the stop pulse, thus allowing a minimum output pulse width of 0.05 microseconds. This pulse goes through three pulse transformer coupled amplifier stages; V25A, V25B, and V26. Pulse transformer T260 couples the amplified pulse into the grids of the leading edge forming tube, V27. This tube drives the output pulse cathode follower, in the pulse forming section, to form the leading edge of the output pulse.

STOP PULSE CHANNEL The stop pulse channel consists of three pulse shaping amplifier stages and the trailing edge forming tube. V35A is ½ of a type 6BQ7A dual triode electron tube. V36 and V37 are type 7119 dual triode electron tubes.

The stop channel receives the positive stop pulse from the width section. It is sent through three stages of transformer coupled amplification; V35A, V36A, and V36B, into the grids of the trailing edge forming tube, V37. This tube drives the output pulse cathode follower, in the pulse forming section, to form the trailing edge of the output pulse.

OUTPUT SECTION The output section consists of the clamp tube, V35B; the pulse forming cathode follower, V40; two power amplifier tubes, V45 and V46; the control grid restoration diode, V47A; and the screen grid disconnect diode,

V47B. Electron tube V35B is ½ of a type 6BQ7A dual triode, V40 is a type 7119 dual triode, V45 and V46 are type 6DQ5 power pentodes, and V47 is a type 6DJ8 dual triode.

The clamp tube receives its input from the plate circuit of V30B in the pulse width section. During the period between output pulses, it conducts fully, holding the output at the zero level. Between the start and stop pulses it is completely cut off by the signal from the width multivibrator and holds the output pulse at full amplitude.

The grids of the pulse forming cathode follower are driven positive by the leading edge forming tube, held there by the clamp tube, and driven back to their original level by the trailing edge forming tube. From the cathodes of this tube, we take the fully shaped output pulse. This pulse is coupled through the rise time control circuitry to the control grids of the power amplifiers.

The power amplifiers, connected in parallel, act as a cathode follower for a positive pulse out, and as an inverting amplifier for a negative pulse out. This is accomplished by the action of the polarity switch, S450, which switches the floating power supply voltages to the output power amplifiers as well as coupling the output pulse to the attenuator.

Triode V47A, connected as a diode, provides restoration at the control grids of the output tubes. The restoration level is adjusted by potentiometer R473. V47B, as connected, acts as the screen grid disconnect diode for the output amplifiers.

Finally, the output pulse is sent to the step attenuator, consisting of five 10db. constant impedance T-sections, and to the pulse output jack on the instrument front panel.

POWER SUPPLY SECTION The power supply section contains the power transformer, T500; V50, a type 0A2 voltage regulator tube; V51, a type 6AS7GA dual triode electron tube; V52, a type 12AX7 dual triode electron tube; V53, a type 6U8 triode-pentode electron tube, and their associated circuitry which includes two controls for varying the amplitude of the output pulse.

The power supply section furnishes five unregulated DC voltages (+250V., -4V., -8V., -18V., and -24V.), and three regulated voltages (+150V., -150V., and a positive variable voltage) from its ground reference supplies. From its floating supply it furnishes 150V. above and below a zero reference. It also furnishes filament power for all of the electron tubes in the unit.

The +150V. supply is regulated by the action of V51A and V52A. The -150V. supply is regulated by the action of the voltage regulator tube, V50.

The positive variable voltage, used in two places; as plate supply for the last stage of start pulse amplification and as plate supp for the clamp tube; furnishes a means of var ing the amplitude of the output pulse. Th supply is regulated by the action of V51B a V52B. Its reference, however, is set by V53B.

This reference may be varied in two way First, it may be varied by varying the fine a tenuator, R531. Secondly, it may be varied the action of the duty cycle limiting contr consisting of the circuitry of T600 and V53A.

Transformer T600 senses the ripple voltage the zero leg of the floating supply. This ri ple voltage increases as the output power ampl fiers draw more current. The bias on the co trol grid of V53A is set at such a level by p tentiometer R602 that the ripple voltage wi take control of the tube at the point where t power amplifiers are drawing rated current a change the reference to lower the variable su ply voltage. Thus, the output tubes are nev allowed to exceed their dissipation ratings ev if the duty factor limitation is inadvertant exceeded. At the time the variable volta starts to decrease due to duty cycle limitin the front panel lamp DS530, lights to warn t operator that the amplitude of the output pul is being automatically reduced.

CIRCUIT THEORY

This section of the manual contains explan tions of several basic circuits which are us in the model B7B. Inasmuch as the technici may not be totally familiar with high repetiti rate pulse handling circuitry, it is felt th the inclusion of this section in the manual wi lend to a more thorough understanding of the i strument.

FREE-RUNNING MULTIVIBRATOR Fig. D is a simpl fied circuit of a free-running multivibrat similar to that used in the oscillator secti of the model B7B.

Arbitrarily assume that at any specified i stant, triode section V1 is conducting fully a triode section V2 is non-conducting because t potential at its control grid is below the cu off potential of the tube. At this instant, t plate voltage of V1 is lowered due to the cu rent flow through V1 and R1. C2 discharges this voltage, holding V2 cut off.

After a time determined by the discharge ti of C2 through R4, the voltage potential on t grid of V2 reaches the cut-in potential of t tube. V2 starts to conduct and its plate pote tial drops. This drop is immediately felt the grid of V1 across C1, driving it to cut-of Its plate potential rises sharply and capacit C2 charges to the new voltage, further aidi

the conduction of V2. After the initial age, V2 steadies to a low plate voltage and discharges to the cut-in potential of V1 and cycle starts over again.

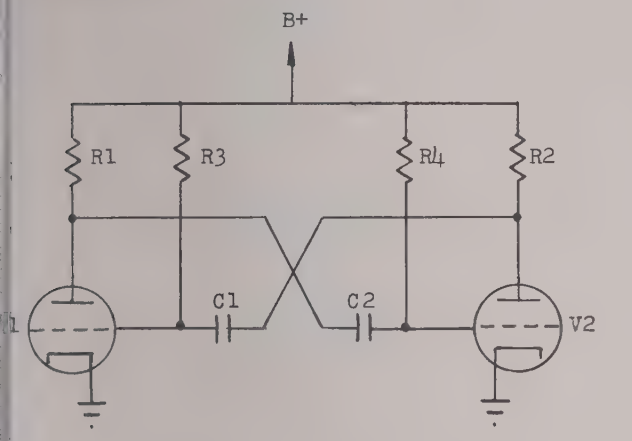


FIG. D FREE-RUNNING MULTIVIBRATOR

In summary, the operation of this circuit sists of periods of time when one tube con- ts a high current while the other tube is off, followed by an extremely rapid change the other tube conducting and the first tube off.

The repetition rate of the circuit is deter- ed by the time constants of C1-R3 and C2-R4 the voltage to which they are returned.

In the model B7B the range of the repetition e of the oscillator is changed by changing values of C1 and C2 in decade steps and the etition rate is made continuously variable each range by varying the level of the grid urn voltage.

OSTABLE MULTIVIBRATOR Fig. E shows a sim- fied circuit of a monostable multivibrator ilar to those used in the pulse delay and se width sections of the model B7B.

The multivibrator has one stable state and quasi-stable state. That is, one tube sec- n is capable of remaining in the conducting te indefinitely while the other does not have s capability. In this type of multivibrator is necessary to trigger the circuit from its ble state to its quasi-stable state with gger pulses from an external source. Then, circuit will automatically return to its ble state after a certain length of time. refore, in operation, one triode section is ggered from non-conduction to conduction with applied trigger. It remains in this condi- n for a predetermined length of time and then urns abruptly to the non-conducting state to ait another trigger. Thus, we are able to nerate a pulse, at a predetermined time after a given input pulse, by abruptly changing a tube section from conduction to non-conduction. Or, essentially, we have introduced a delay into the system.

Assume that the circuit is in its stable state. V1 is conducting, its grid clamped to its cathode. If R2 is made quite large, the full conduction current through V1 and thus through R6 is small and the grid is clamped near zero potential. The plate of V1, however, is at quite a low potential due to the current through the large R2. V2 is not conducting, its grid held below cut-off by the divider formed by R3, R4, and R7 between the low positive plate potential of V1 and -150 volts.

Now, at some time, a positive timing pulse arrives at the junction of the C2-R3, C3-R4 combination through diode CR1. This pulse is felt sharply across C2 and C3 at the plate of V1 and the grid of V2. V1 starts to cut off. V2 starts conducting. If R5 is small compared to R2, V2 will conduct much more heavily than V1

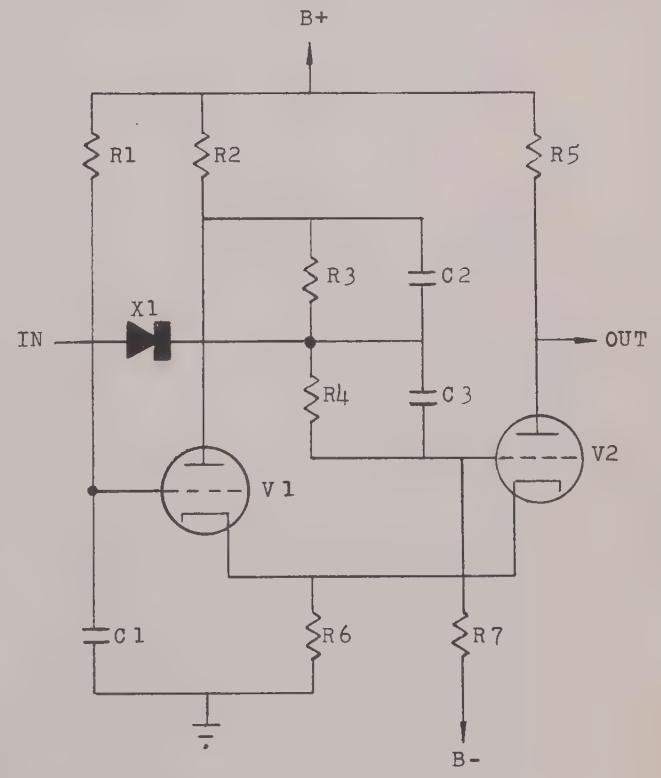


FIG. E MONOSTABLE MULTIVIBRATOR

was conducting. The drop across R6 becomes greater due to this higher current through V2, thus the cathodes raise to a higher potential. This holds V1 off completely. The plate of V1,

now at a higher potential, keeps the grid of V2 above its cut-off potential by the same divider network mentioned above. Thus, in a very short time, a trigger pulse has changed the state of the multivibrator from that of V1 conducting a small amount and V2 cut off, to one of V1 cut off and V2 conducting quite heavily.

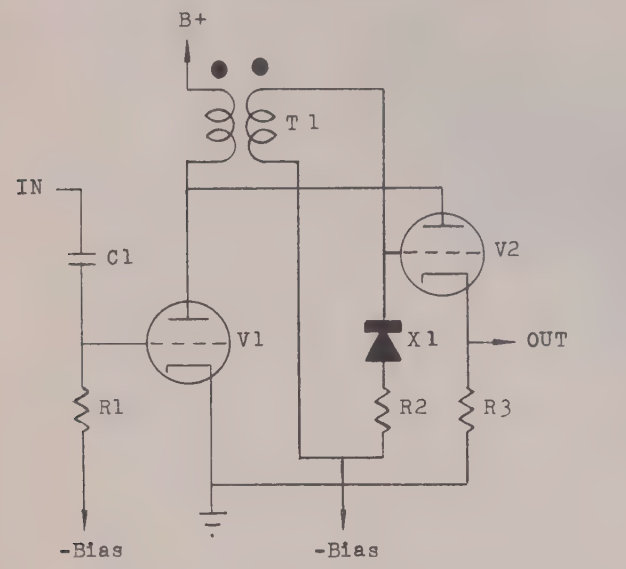


FIG. F MONOSTABLE BLOCKING OSCILLATOR

As soon as V1 is cut off by raising its cathode potential several volts with respect to its grid potential, C1 starts to charge through R1 toward the B+ potential. After a time, predetermined by the R1-C1 combination, the grid of V1 will reach cut-in potential and V1 will again start to conduct. The plate of V1 drops. This drop is felt at the grid of V2 through C2 and C3, immediately cutting off V2. The drop which cuts V2 off also drops the cathode potentials, which aids the conduction of V1. C1 discharges rapidly through the low grid to cathode resistance of V1, and the circuit has returned to its original stable state. At the transition point of V2 conducting to non-conducting, the plate waveform of V2 goes sharply positive. This waveform is taken as the output. Thus, we have produced a pulse, delayed from the original trigger pulse, by a time predetermined by R1-C1.

In the model B7B the range of delay of the pulse delay and pulse width multivibrators is changed by changing the value of C1 in decade steps. Delay and width are made continuously variable through any range by varying R6, which varies the cathode potential in the quasi-stable state, thus determining the potential which the grid must reach to cut V1 on and return the multivibrator to its stable state.

BLOCKING OSCILLATOR Fig. F shows a typical blocking oscillator circuit such as is used in the model B7B oscillator and pulse delay sections.

This blocking oscillator is a so-called monostable or driven type. That is, it is not free-running, but requires a trigger from an external source to excite it. It produces a high powered, extremely sharp, narrow pulse which is essentially independent of the shape or degradation of the pulse which triggers it.

V1 serves to amplify the input trigger and to eliminate the possibility of a reaction by the blocking oscillator back on the trigger pulse source.

In the quiescent condition, both sections of the tube are biased below cut-off. A positive trigger is coupled through C1 to the amplifier tube, V1, which inverts and amplifies it. Pulse transformer T1 inverts and applies this waveform to the grid of V2, the blocking oscillator tube. V2 conducts causing a drop in its plate voltage. The drop in plate voltage in turn causes an increase in grid voltage, which results in a further decrease in plate voltage. Due to the AC loop gain of the circuit being greater than unity, regeneration occurs. The plate drives abruptly downward and the grid abruptly upward. This action continues until such time as the loop gain drops below unity, due to the nonlinearity of the tube.

The plate and grid cannot remain at the values attained by the regenerative action described above because of the low frequency characteristics of the transformer. The grid starts to drop due to its finite magnetizing inductance. When the grid voltage has dropped far enough that the loop gain once again equals unity, a regenerative action once again occurs in the direction to turn the tube off.

An overshoot occurs at the plate and grid of the tube. At the conclusion of the pulse there is still a current flowing in the magnetizing inductance of the transformer. Since this current cannot change instantaneously, it continues to flow through the effective capacitance of the transformer after the tube current has dropped to zero, causing this overshoot.

The pulse width and rise time are dependent almost entirely on the design of the transformer. The pulse transformers used in the model B7B blocking oscillators are specifically designed to produce extremely narrow, fast rise time pulses.

In the oscillator and pulse widht sections of the model B7B, blocking oscillators such as described above are used. In both of these cases, a positive pulse is taken from the cathode as the output pulse.

CHMITT TRIGGER Figure "G" shows a typical itt Trigger circuit such as is used in the l B/B Oscillator section.

he Schmitt Trigger is a mono-stable circuit, is, it is not free running but requires a ger from an external source to excite it. circuit produces an extremely sharp pulse h is essentially independent of the ampli- and waveform of the pulse which triggers

n the quiescent condition, V-2 is conduct- V-1 is not conducting, its grid held below off by the divider network formed by R-4 and between the cathodes of V-1 and V-2 and ground. A positive trigger is coupled through C-1 to the grid of V-1 causing the tube to conduct. For an instant, the voltage across the cathode resistors increases driving the grid of V-2 towards cut-off. This, in addition with the drop-in plate voltage of V-1, causes a rapid change in V-2 from conducting to a cut-off condition. V-2 will remain cut-off until the input signal has decreased to the cut-off value of V-1. As soon as V-1 is cut off by the changing input signal, the plate voltage of V-1 will rise, causing the voltage on the grid of V-2 to rise, and V-2 conducts.

Thus, in a short time the circuit has been triggered between its two stable states by a trigger pulse whose amplitude exceeds a definite positive value and changes to a definite less positive value.

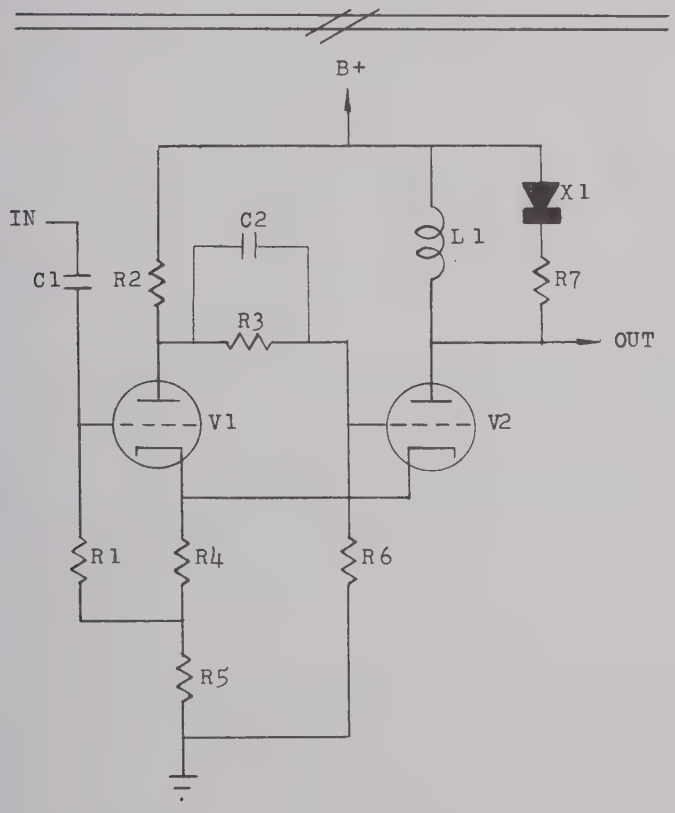


FIG. G SCHMITT TRIGGER

PARTS LIST

This parts list contains identifying information on all of the replaceable parts contained in the model B7B. These parts are listed in alpha-numerical order by schematic symbol number. Some items have no symbol number, but are considered to be replaceable parts.

The column headed "ITEM #" is the component identifying number assigned by the RUTHERFORD ELECTRONICS CO.

The column headed "SYMBOL #" designates the component as it is found on the schematic diagrams, drawing numbers B7B-104, B7B-110, and B7B-111.

The column headed "DESCRIPTION" is, in general, a full electrical description of the component.

The column headed "SUGGESTED VENDOR" is merely an indication of one source from which the component is available. In filling any order for spare parts, the RUTHERFORD ELECTRONICS CO. reserves the right to make SUBSTITUTIONS, for any component listed in this list, with a component from a different vendor, or the same vendor, if we deem the new component to perform satisfactorily in the instrument.

The column headed "VENDOR PART NO." is the part number assigned to the component by the vendor listed in the previous column. In cases where no part No. is given, the component should be ordered by its description.

The column headed "SUGGESTED UNIT PRICE" gives only an indication of the probable cost for a single unit of the component or assembly listed, if purchased from the RUTHERFORD ELECTRONICS CO. It is not, in any case, to be construed as a firm price quotation. Any customer wishing to purchase a complete or partial set of spare parts should enter a request for quotation of price and delivery to the RUTHERFORD ELECTRONICS CO. or their authorized representatives.

The column headed "SUGGESTED SPARES" list the quantity of each of the items which the manufacturer recommends as spares for one (1) years operation.

When ordering a manual please indicate the instrument model number and its serial number and date of original purchase. For spare parts, we suggest, 1) a careful description of the part, and 2) the model number and serial number of the instrument and date of original purchase. If possible, please identify parts in relation to the schematic, giving data shown on the circuit schematic diagram.

When ordering a complete or partial set of spares, specify by listing all of the information contained in this list for that particular part. The more descriptive information given on a parts order, the less chance there is for expensive and time consuming error.

Minimum parts order billing is $7.50. Prices are subject to change without notice.

ABBREVIATIONS

cer	ceramic	k	kilohm or 10^3 ohms	prec	precision
comp	composition	m	milli or 10^{-3}	PT	paper tubular
EMC	electrolytic, metal cased	meg	megohm or 10^6 ohms	SM	silvered mica
EMT	electrolytic, metal tubular	MF	metal film	V	working volts, DC
f	farad	μ	micro or 10^{-6}	var	variable
GMV	guaranteed minimum value	$\mu\mu$	micromicro or 10^{-12}	W	watt
h	henry	Ω	ohm	WW	wire wound
MM	Metalized mylar				

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
B7B-1	C100	CAPACITOR, fixed, cer, 0.01µf, 500V, GMV	Various			.15	16
	C101	See B7B-1					
	C102	See B7B-1					
	C103	See B7B-1					
	C104	See B7B-1					
	C105	See B7B-1					
B7B-2	C110	CAPACITOR, fixed, mylar, 0.47µf, 150V, ±1%	Electro-Cube	250B1C474F		2.25	2
	C111	See B7B-2					
B7B-3	C112	CAPACITOR, fixed, mylar, 0.047µf, 150V, ±1%	Electro-Cube	250B1C473F		2.28	2
	C113	See B7B-3					
B7B-4	C114	CAPACITOR, fixed, SM, 4700µµf, 500V, ±1%	Sangamo	CR5C472-F0		1.22	2
	C115	See B7B-4					
B7B-5	C116	CAPACITOR, fixed, SM, 470µµf, 500V, ±1%	Sangamo	KR5E471-F0		.73	2
	C117	See B7B-5					
B7B-6	C118	CAPACITOR, var, mica, 5-80µµf, 175V	Arco	462		.55	2
B7B-7	C119	CAPACITOR, fixed, SM, 47µµf, 500V, ±5%	Sangamo	DR5E470-J0		.40	1
B7B-8	C120	CAPACITOR, fixed, cer, 100µµf, 500V, ±10%	Various			.15	3
B7B-9	C121	CAPACITOR, fixed, SM, 5µµf, 500V, ±5%	Sangamo	RR1550		.40	1
	C122	See B7B-1					
	C123	See B7B-1					
	C130	See B7B-8					
	C131	See B7B-1					
	C132	See B7B-1					
	C200	See B7B-2					
	C201	See B7B-3					
	C202	See B7B-4					
	C203	See B7B-5					
	C204	See B7B-6					
	C205	See B7B-1					
B7B-10	C206	CAPACITOR, fixed, SM, 100µµf, 500V, ±5%	Sangamo	DR5E101-J0		.40	3
	C207	See B7B-10					
	C208	See B7B-8					
	C209	See B7B-1					
	C210	See B7B-8					
	C211	See B7B-1					
	C212	See B7B-1					
	C213	See B7B-1					
	C250	See B7B-1					
B7B-11	C260	CAPACITOR, var, cer, 1.5-7µµf, 500V	Erie	TSA		1.05	1
	C261	See B7B-1					
	C300	See B7B-2					
	C301	See B7B-3					
	C302	See B7B-4					

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
	C303	See B7B-5					
	C304	See B7B-6					
	C306	See B7B-10					
	C307	See B7B-10					
	C308	See B7B-8					
B7B-12	C309	CAPACITOR, fixed, EMT, 2µf, 450V, -10+50%	Sangamo	MT4502		1.00	2
B7B-13	C310	CAPACITOR, fixed, MM, 0.25µf, 400V, ±20%	Electro-Cube	210B1E254		1.20	2
	C311	See B7B-1					
B7B-14	C350	CAPACITOR, var, cer, 2.7-30µµf, 175V	Arco	461		.50	1
	C351	See B7B-1					
	C352	See B7B-1					
	C360	See B7B-14					
	C361	See B7B-1					
	C362	See B7B-1					
	C363	See B7B-1					
B7B-15	C400	CAPACITOR, fixed, MM, 0.5µf, 600V, ±20%	Electro-Cube	210B1F504		1.59	1
	C401	See B7B-1					
B7B-16	C404	CAPACITOR, fixed, cer, 0.03µf, 500V, GMV	Various			.20	1
	C405	See B7B-12					
B7B-17	C450	CAPACITOR, fixed, EMT, 20µf, 250V, -10+50%	Sangamo	MT2520		1.35	2
	C451	See B7B-1					
B7B-18	C452	CAPACITOR, fixed, SM, 33µµf, 500V, ±5%	Sangamo	DR5E330-J0		.40	1
B7B-19	C453	CAPACITOR, fixed, SM, 22µµf, 500V, ±5%	Sangamo	DR5E220-J0		.40	1
	C460	See B7B-17					
	C461	See B7B-1					
	C462	See B7B-18					
	C470	See B7B-13					
	C471	See B7B-1					
B7B-20	C472	CAPACITOR, var, mica, 9-180µµf, 175V	Arco	463		.60	1
	C473	See B7B-1					
	C474	See B7B-13					
B7B-21	C500	CAPACITOR, fixed, EMC, 80-80µf, 350V, -10+50%	Sangamo	PLDP~~3580~~ -175		4.50	2
	C501	See B7B-21					
	C502	See B7B-21					
B7B-22	C503	CAPACITOR, fixed, PT, 0.1µf, 400V, ±20%	Sprague	160P10404		.35	3

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
	C520	See B7B-22					
	C521	See B7B-12					
	C522	See B7B-22					
	C523	See B7B-12					
	C530	See B7B-22					
	C531	See B7B-22					
B7B-23	C600	CAPACITOR, fixed, EMT, 50μf, 25V, -10+100%	Sprague	VL 1215		2.10	1
B7B-24	C601	CAPACITOR, fixed, EMC, 200-200μf, 250V, -10+50%	Sangamo	PLDP-118		6.00	2
	C602	See B7B-24					
	C603	See B7B-24					
	C604	See B7B-24					
B7B-25	C700	CAPACITOR, fixed, EMC, 1500μf, 50V, -10+50%	Sangamo	PLPS-064		4.00	1
B7B-26	C801	CAPACITOR, fixed, MM, 2μf, 400V, ±20%	Electro-Cube	210B1E205		2.25	1
	C804	See B7B-26					
B7B-27	C805	CAPACITOR, fixed, cer, 22μμf, 1KV, ±20%	Various			.15	1
B7B-28	CR120	DIODE, germanium	Hughes Prod.	1N116		1.50	4
B7B-29	CR130	DIODE, germanium	Hughes Prod.	1N34A		.45	3
	CR200	See B7B-29					
	CR201	See B7B-28					
	CR210	See B7B-29					
B7B-30	CR250	DIODE, germanium	Various	1N774		.82	3
	CR251	See B7B-30					
	CR300	See B7B-29					
	CR301	See B7B-28					
	CR350	See B7B-30					
	CR360	See B7B-30					
	CR361	See B7B-30					
B7B-31	CR500	DIODE, silicon, 750ma, 400PIV	Sem-Tech	SC-4		1.10	14

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
	CR501	See B7B-31					
	CR502	See B7B-31					
	CR503	See B7B-31					
	CR504	See B7B-31					
	CR505	See B7B-31					
	CR530	See B7B-31					
	CR600	See B7B-31					
	CR601	See B7B-31					
	CR602	See B7B-31					
	CR603	See B7B-31					
	CR604	See B7B-31					
	CR700	See B7B-31					
	CR701	See B7B-31					
B7B-32	DL100	DELAY LINE, fixed 0.2μsec.	RUTHERFORD	SD-A-215		8.50	1
B7B-33	DL210	DELAY LINE, fixed 0.02μsec.	RUTHERFORD	SD-A-216		8.50	1
B7B-34	F500	FUSE, slo-blo 4 amp.	Bussman	MDX-4		.18	5
B7B-35	FB400	FERRITE BEAD	Ferroxcube	56-590-65/3B		.40	2
	FB450	See B7B-35					
	FB460	See B7B-35					
B7B-36	DS500	LAMP, indicator	G. E.	47		.15	1
B7B-37	DS530	LAMP, indicator	G. E.	NE-51		.21	1
B7B-38	J100	NYLON binding post	Johnson	111-103		.38	1
	J101	See B7B-38					
B7B-39	J800	CONNECTOR, coax,	RUTHERFORD	SO-239		1.00	1
B7B-40	L120	COIL, fixed, 75μh, ±10%	RUTHERFORD	1075-15		.90	1
B7B-41	L200	COIL, fixed, 25μh, ±10%	RUTHERFORD	1025-15		.85	1
	L300	See B7B-41					
B7B-42	P500	CORD, power, w/plug, 3 wire	RUTHERFORD	SD-B-143		1.12	1

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
B7B-43	R100	RESISTOR, fixed, comp, 150K, ½W, ±10%	Al-Brad.	EB 1541		.12	2
B7B-44	R101	RESISTOR, fixed, comp, 1K, ½W, ±10%	Al-Brad.	EB 1021		.12	3
B7B-45	R102	RESISTOR, fixed, comp, 10K, ½W, ±10%	Al-Brad.	EB 1031		.12	1
	R103	See B7B-44					
	R104	See B7B-44					
B7B-46	R105	RESISTOR, fixed, comp, 680Ω, ½W, ±10%	Al-Brad.	EB 6811		.12	1
B7B-47	R110	RESISTOR, fixed, comp, 1K, 1W, ±10%	Al-Brad.	GB 1021		.18	2
B7B-48	R111	RESISTOR, var, comp, 10K, 2W, ±20%	RUTHERFORD	~~B7B-B-513-4~~ SPEC. 32501		3.00 ~~3.75~~	1
	R112	See B7B-47					
B7B-49	R113	RESISTOR, fixed, comp, 75K, ½W, ±5%	Al-Brad.	EB 7535		.24	1
	R114	See B7B-49					
	R115	See B7B-48 RESISTOR, VAR, COMP 10K, 2W, ±20%	RUTHERFORD	B7B-7		3.75	1
B7B-50	R116	RESISTOR, var, comp, 5K, 1W, ±20%	RUTHERFORD	Spec. 31872		3.00	1
B7B-51	R117	RESISTOR, fixed, comp, 4.7K, 2W, ±10%	Al-Brad.	HB 4721		.24	1
B7B-52	R118	RESISTOR, fixed, comp, 4.7K, 1W, ±10%	Al-Brad.	GB 4721		.18	1
B7B-53	R120	RESISTOR, fixed, comp, 3.3K, ½W, ±10%	Al-Brad.	EB 3321		.12	1
B7B-54	R121	RESISTOR, fixed, comp, 470Ω, ½W, ±10%	Al-Brad.	EB 4711		.12	3
	R122	See B7B-43					
B7B-55	R123	RESISTOR, fixed, comp, 1 meg, ½W, ±10%	Al-Brad.	EB 1051		.12	1
B7B-56	R124	RESISTOR, fixed, comp, 1.2K, ½W, ±10%	Al-Brad.	EB 1221		.12	1
B7B-57	R125	RESISTOR, fixed, comp, 6.8K, ½W, ±10%	Al-Brad.	EB 6821		.12	1
B7B-58	R126	RESISTOR, fixed, comp, 68K, ½W, ±10%	Al-Brad.	EB 6831		.12	1
B7B-59	R127	RESISTOR, fixed, comp, 39K, ½W, ±10%	Al-Brad.	EB 3931		.12	1
B7B-60	R128	RESISTOR, fixed, comp, 3.3 meg, ½W, ±10%	Al-Brad.	EB 3351		.12	1
	R130	See B7B-54					
	R131	See B7B-47					
	R132	See B7B-44					
B7B-61	R200	RESISTOR, var, comp, 100K, 1W, ±20%	RUTHERFORD	Spec. 31874		3.00	1
B7B-62	R201	RESISTOR, fixed, comp, 100K, ½W, ±10%	Al-Brad.	EB 1041		.12	3
B7B-63	R202	RESISTOR, fixed, comp, 47Ω, ½W, ±10%	Al-Brad.	EB 4701		.12	2
	R203	See B7B-54					
B7B-64	R204	RESISTOR, fixed, prec, 100K, ½W, ±1%	Various			.60	1
B7B-65	R205	RESISTOR, fixed, comp, 27K, ½W, ±10%	Al-Brad.	EB 2731		.12	2
B7B-66	R206	RESISTOR, fixed, comp, 12K, ½W, ±10%	Al-Brad.	EB 1231		.12	1
B7B-67	R207	RESISTOR, fixed, comp, 220Ω, 2W, ±10%	Al-Brad.	HB 2211		.24	1

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
7B-68	R208	RESISTOR, var, comp, 500Ω, 2W, ±20%	RUTHERFORD	B7B-B-513-1		3.75	1
7B-69	R209	RESISTOR, fixed, comp, 300K, ½W, ±5%	Al-Brad.	EB 3045		.24	1
	R210	See B7B-54					
	R211	See B7B-53					
7B-70	R212	RESISTOR, fixed, comp, 470Ω,2W, ±10%	Al-Brad.	HB 4711		.24	1
	R250	See B7B-44					
7B-71	R251	RESISTOR, fixed, comp, 150Ω, ½W, ±10%	Al-Brad.	EB 1511		.12	1
7B-72	R252	RESISTOR, fixed, comp, 330Ω, ½W, ±10%	Al-Brad.	EB 3311		.12	2
7B-73	R260	RESISTOR, fixed, comp, 1K, 2W, ±10%	Al-Brad.	HB 1021		.24	1
	R261	See B7B-73					
	R300	See B7B-61					
	R301	See B7B-62					
	R302	See B7B-63					
	R303	See B7B-54					
	R304	See B7B-64					
	R305	See B7B-65					
	R306	See B7B-66					
	R307	See B7B-70					
	R308	See B7B-68					
	R309	See B7B-69					
7B-74	R350	RESISTOR, fixed, comp, 470K, ½W, ±10%	Al-Brad.	EB 4741		.12	3
	R351	See B7B-53					
	R352	See B7B-72					
7B-75	R353	RESISTOR, var, comp, 250K, 2W, ±30%	RUTHERFORD	Spec. 32560		3.00	1
7B-76	R354	RESISTOR, var, comp, 50K, 2W, ±30%	RUTHERFORD	Spec. 32338		3.00	1
	R355	See B7B-43					
7B-77	R356	RESISTOR, fixed, comp, 68K, 2W, ±10%	Al-Brad.	HB 6831		.24	1
	R357	See B7B-65					
	R360	See B7B-72					
	R361	See B7B-72					
7B-78	R400	RESISTOR, fixed, comp, 22K, 2W, ±10%	Al-Brad.	HB 2231		.24	1
7B-79	R401	RESISTOR, var, comp, 10K, 2W, ±30%	RUTHERFORD	~~B7B-B-513-4~~ Spec. 32339		~~3.75~~ 3.00	1
7B-80	R402	RESISTOR, fixed, comp, 3.3K, 2W, ±10%	Al-Brad.	HB 3321		.24	1
7B-81	R450	RESISTOR, fixed, comp, 10Ω, 2W, ±10%	Al-Brad.	HB 1001		.24	1
	R452	See B7B-63					
7B-82	R453	RESISTOR, fixed, comp, 100Ω, ½W, ±10%	Al-Brad.	EB 1011		.12	1

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
	R460	See B7B-81					
	R462	See B7B-63					
	R470	See B7B-55					
B7B-83	R471	RESISTOR, fixed, comp, 1.5K, ½W, ±10%	Al-Brad.	EB 1521		.12	1
	R472	See B7B-51					
B7B-84	R473	RESISTOR, var, comp, 5K, 2W, ±30%	RUTHERFORD	Spec. 32337		3.00	1
	R474	See B7B-80					
	R475	See B7B-82					
	R500	See B7B-62					
B7B-85	R501	RESISTOR, fixed, WW, 3K, 10W, ±10%	Various			.88	1
B7B-86	R502	RESISTOR, fixed, comp, 150K, 1W, ±10%	Al-Brad.	GB ~~1531~~ 1541		.18	1
B7B-87	R510	RESISTOR, fixed, comp, 10Ω, ½W, ±10%	Al-Brad.	EB 1001		.12	1
B7B-88	R511	RESISTOR, fixed, prec, 73.2K, ½W, ±1%	Various			.60	1
B7B-89	R512	RESISTOR, fixed, prec, 68.1K, ½W, ±1%	Various			.60	1
	R513	See B7B-87					
B7B-90	R514	RESISTOR, fixed, comp, 220K, ½W, ±5%	Al-Brad.	EB 2245		.24	1
B7B-91	R515	RESISTOR, fixed, comp, 150K, ½W, ±5%	Al-Brad.	EB 1545		.24	1
B7B-92	R516	RESISTOR, fixed, WW, 1.5K, 25W, ±10%	Various			1.18	1
B7B-93	R520	RESISTOR, fixed, comp, 220K, ½W, ±10%	Al-Brad.	EB 2241		.12	1
	R521	See B7B-74					
	R522	See B7B-78					
B7B-94	R530	RESISTOR, fixed, comp, 270K, ½W, ±5%	Al-Brad. RUTHERFORD	EB 2745 B7B-B-5132		.24	1
B7B-95	R531	RESISTOR, var, comp, 250K, 2W, ±20%	~~Al-Brad.~~	JAIN048P254MA		~~4.04~~	1
B7B-96	R532	RESISTOR, fixed, comp, 680K, ½W, ±10%	Al-Brad.	EB 6841		.12	1
B7B-97	R533	RESISTOR, fixed, comp, 120K, ½W, ±10%	Al-Brad.	EB 1241		.12	1
	R534	See B7B-62					
B7B-98	R535	RESISTOR, fixed, comp, 6.8K, 2W, ±10%	Al-Brad.	HB 6821		.24	1
	R536	See B7B-98					
B7B-99	R600	RESISTOR, fixed, WW, 0.75Ω, 5W, ±5%	Various			.85	1
	R601	See B7B-60					
B7B-100	R602	RESISTOR, var, comp, 50K, 1W, ±30%	RUTHERFORD	31921 Spec. ~~32338~~		3.00	1
B7B-101	R603	RESISTOR, fixed, comp, 15K, ½W, ±10%	Al-Brad.	EB 1531		.12	1

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
	R604	See B7B-62					
	R605	See B7B-62					
B7B-102	R700	RESISTOR, fixed, comp, 47Ω, 2W, ±5%	Al-Brad.	HB-4705		.48	1
B7B-103	R701	RESISTOR, fixed, comp, 160Ω, 2W, ±5%	Al-Brad.	HB 1615		.48	1
B7B-104	R702	RESISTOR, fixed, comp, 33Ω, 1W, ±5%	Al-Brad.	GB 3305		.36	2
	R703	See B7B-104					
	R704	See B7B-104					
B7B-105	R705	RESISTOR, fixed, comp, 160Ω, 2W, ±5%	Al-Brad.	HB 1615		.48	1
B7B-106	R800	RESISTOR, fixed, MF, 270Ω, 8W, ±5%	Welwyn	F 34		.82	3
	R801	See B7B-106					
	R802	See B7B-106					
B7B-107	R803	RESISTOR, fixed, MF, 75Ω, 6W, ±5%	Welwyn	F 33		.74	3
	R804	See B7B-107					
	R805	See B7B-107					
B7B-108	R806	RESISTOR, fixed, comp, 82K, ½W, ±10%	Al-Brad.	EB 8231		.12	1
	R807	See B7B-108					
B7B-109	R810	RESISTOR, fixed, MF, 2ea., 52Ω, 6W, ±5%	Welwyn	F 33		.74	1
B7B-110	R811	RESISTOR, fixed, MF, 26Ω, 6W, ±5%	Welwyn	F 33		.74	1
B7B-111	R812	RESISTOR, fixed, MF, 2ea., 70Ω, 6W, ±5%	Welwyn	F 33		.74	1
B7B-112	R820	RESISTOR, fixed, MF, 26Ω, 4W, ±5%	Welwyn	F 32		.69	1
	R821	See B7B-112					
B7B-113	R822	RESISTOR, fixed, MF, 35Ω, 4W, ±5%	Welwyn	F 32		.69	1
B7B-114	R830	RESISTOR, fixed, comp, 27Ω, ½W, ±5%	Al-Brad.	EB 2705		.24	3
	R831	See B7B-114					
B7B-115	R832	RESISTOR, fixed, comp, 36Ω, ½W, ±5%	Al-Brad.	EB 3605		.24	2
	R840	See B7B-114					
	R841	See B7B-114					
	R842	See B7B-115					
	R850	See B7B-114					
	R851	See B7B-114					
	R852	See B7B-115					
B7B-116	RT500	THERMISTOR 5Ω, 10W, ±20%	RUTHERFORD	M520-102		1.60	3

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO.		SUGGESTED UNIT PRICE	SUGGESTED SPARES
B7B-117	S100	SWITCH, toggle, SPDT, Ext. Trig. Polarity	A. H. & H.	81021AV		2.82	1
B7B-118	S110	SWITCH, rotary, Rep. Rate Range	RUTHERFORD	B7B-B-519		7.26	1
B7B-119	S200	SWITCH, rotary, Delay Range	RUTHERFORD	B7B-B-520		6.33	1
	S300	See B7B-119 Width Range					
B7B-120	S450	SWITCH, rotary, Polarity (Unassembled)	RUTHERFORD	B7B-B-522		4.92	1
B7B-121	S500	SWITCH, toggle, SPST, On-Off	A. H. & H.	80994 BX		1.80	1
B7B-122	S800	SWITCH, rotary Step Attenuator (Unassembled)	RUTHERFORD	B7B-B-521		5.52	1
B7B-123	T130	TRANSFORMER, pulse	RUTHERFORD	B7-501		7.50	2
	T210	See B7B-123					
B7B-124	T250	TRANSFORMER, pulse	RUTHERFORD	B7-502		7.50	3
B7B-125	T251	TRANSFORMER, pulse	RUTHERFORD	B7-504		7.50	3
	T260	See B7B-125					
	T350	See B7B-124					
	T360	See B7B-124					
	T361	See B7B-125					
B7B-126	T500	TRANSFORMER, power	RUTHERFORD	B7-D-500		38.00	1
B7B-127	T600	TRANSFORMER, Audio	Triad	45753		4.20	1
B7B-128	V10	ELECTRON TUBE	Amperex	6DJ8		4.55	11
	V11	See B7B-128					
	V12	See B7B-128					
	V13	See B7B-128					
	V20	See B7B-128					
B7B-129	V21	ELECTRON TUBE	G. E.	6BQ7A		3.95	5
B7B-130	V25	ELECTRON TUBE	Amperex	7119		5.90	8
	V26	See B7B-130					

ITEM NO.	SYMBOL NO.	DESCRIPTION	SUGGESTED VENDOR	VENDOR PART NO		SUGGESTED UNIT PRICE	SUGGESTED SPARES
	V27	See B7B-129					
	V30	See B7B-128					
	V35	See B7B-129					
	V36	See B7B-130					
	V37	See B7B-130					
	V40	See B7B-130					
B7B-131	V45	ELECTRON TUBE	R.C.A.	6DQ5		7.70	3
	V46	See B7B-131					
	V47	See B7B-128					
B7B-132	V50	ELECTRON TUBE	R.C.A.	0A2		1.46	2
B7B-133	V51	ELECTRON TUBE	G.E., R.C.A.	6AS7GA		4.95	2
B7B-134	V52	ELECTRON TUBE	G.E.	12AX7		2.55	2
B7B-135	V53	ELECTRON TUBE	G.E.	6U8A		3.30	2
B7B-136		ASSY, switch, rep rate, w/comps assembled	RUTHERFORD	B7B-A-214		26.44	1
B7B-137		ASSY, switch, delay, w/comps assembled	RUTHERFORD	B7B-A-213		16.60	1
B7B-138		ASSY, switch, width, w/comps assembled	RUTHERFORD	B7B-A-212		16.60	
B7B-139		ASSY, switch, polarity, w/comps assembled	RUTHERFORD	B7B-A-210		46.90	
		See B7B-139 Attenuator					
B7B-140		ASSY, cover, top,	RUTHERFORD	B7B-A-222		7.50	
B7B-141		ASSY, cover, bottom,	RUTHERFORD	B7B-A-223		4.00	
B7B-142		ASSY, cover, end two (2) per unit	RUTHERFORD	B7B-A-224		18.00 per set	
B7B-143		BINDING POST	Gen. Radio	938 A		.55	1
B7B-144		HOLDER, fuse	Bussman	HKP		.62	1
B7B-145		HOLDER, lamp, green	Dialco	810-B-432		.64	1
B7B-146		HOLDER, lamp, clear	Dialco	810-B-435		.64	1
B7B-147		KNOB, instrument 10 db step atten. or ~~Fine attenuator~~	RUTHERFORD	SD-D-182-3		2.65	1
B7B-148		KNOB, instrument, fine rep. rate, delay or width, FINE ATTENUATOR	RUTHERFORD	SD-D-182-4		2.65	2
B7B-149		KNOB, instrument, ~~Rise time control~~ or polarity	RUTHERFORD	SD-A-183-1		2.25	1
B7B-150		KNOB, instrument, Coarse rep. rate, Delay or Width, RISE TIME	RUTHERFORD	SD-D-183-2		2.25	2
B7B-151		MOTOR, fan	Barcol	DYAB-571-~~710~~ 3		5.75	1
B7B-152		MANUAL, instruction	RUTHERFORD	J025-2		5.00	1
B7B-153		PANEL, front, w/silk screen	RUTHERFORD	B7B-F-415		14.00	
B7B-154		SPACER, binding post	Gen. Radio	938 F		.15	1

TOTAL SUGGESTED PRICE - ONE (1) SET OF SUGGESTED SPARES - $ 539.58

WARRANTY

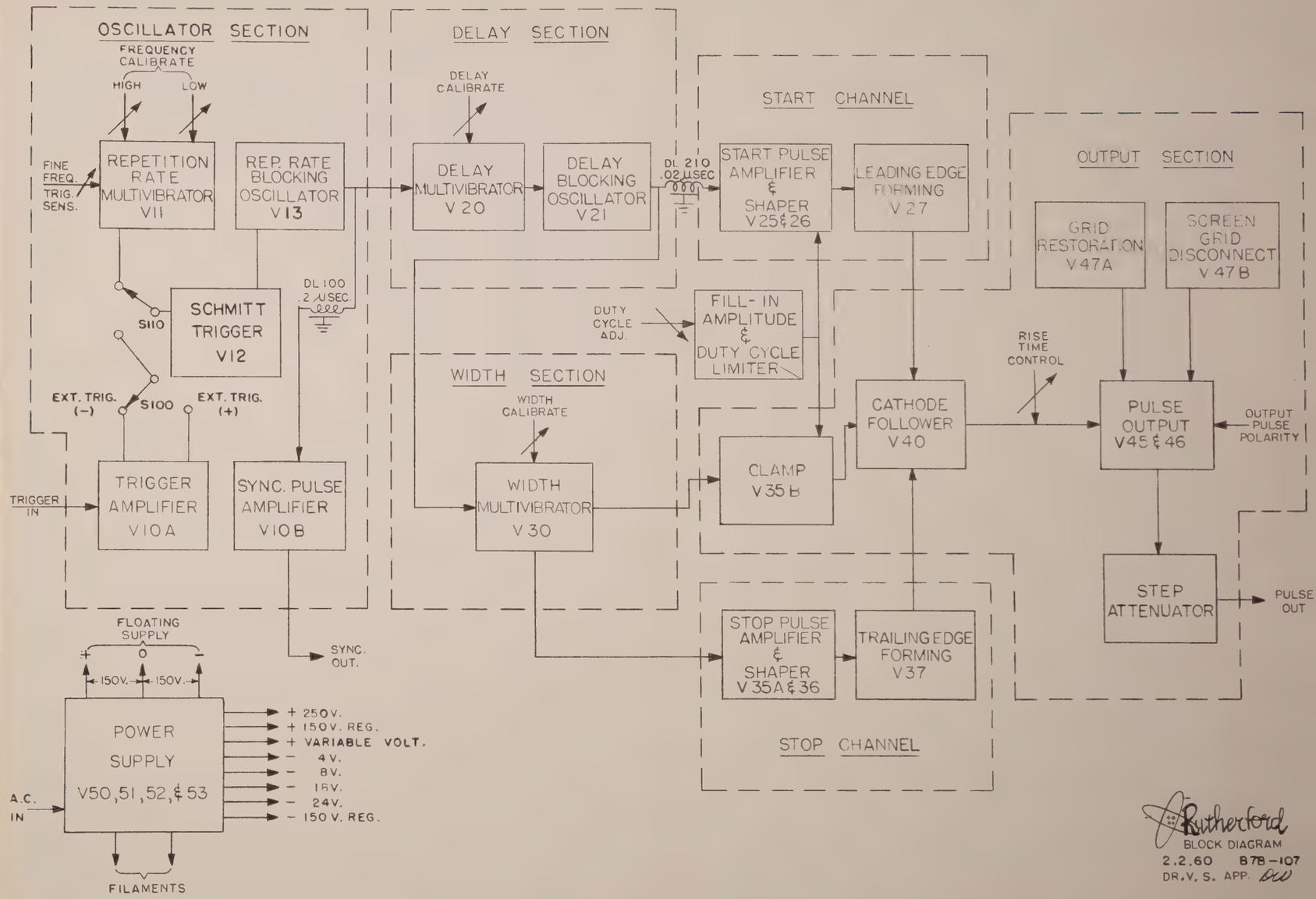
The RUTHERFORD ELECTRONICS CO. warrants to the original purchaser for a period of one (1) year, EXCEPT electron tubes and semiconductors which are warranted for ninety (90) days, after date of delivery that this instrument is free of defects in material and workmanship under normal use and service. Our liability is limited to repair or replacement of this instrument or defective parts, providing failure is not due to misuse, negligence, or accident.

In order to receive service under this warranty, promptly advise the factory of all details pertinent to failure of the instrument. Defective parts or instruments should be returned to the factory, shipment prepaid, for examination by the manufacturer to determine whether it is defective. The parts or units will be replaced or repaired and returned to the purchaser via surface transportation, freight prepaid.

Instruments on which the warranty does not apply or has expired will be repaired and billed to the purchaser on a parts and labor basis.

This warranty applies to used instruments for a ninety (90) day period. Warranty also applies to repairs to the extent of the repair only, for a period of thirty (30) days.

This warranty supersedes previous warranties and is expressly in lieu of any other warranties, expressed or implied, and the RUTHERFORD ELECTRONICS CO. neither assumes or authorizes any other person to assume for it any liability in connection with the instrument which is the subject of this warranty.



LTR	DATE	CO NO	BY

Rutherford

BLOCK DIAGRAM

2.2.60 B78-107

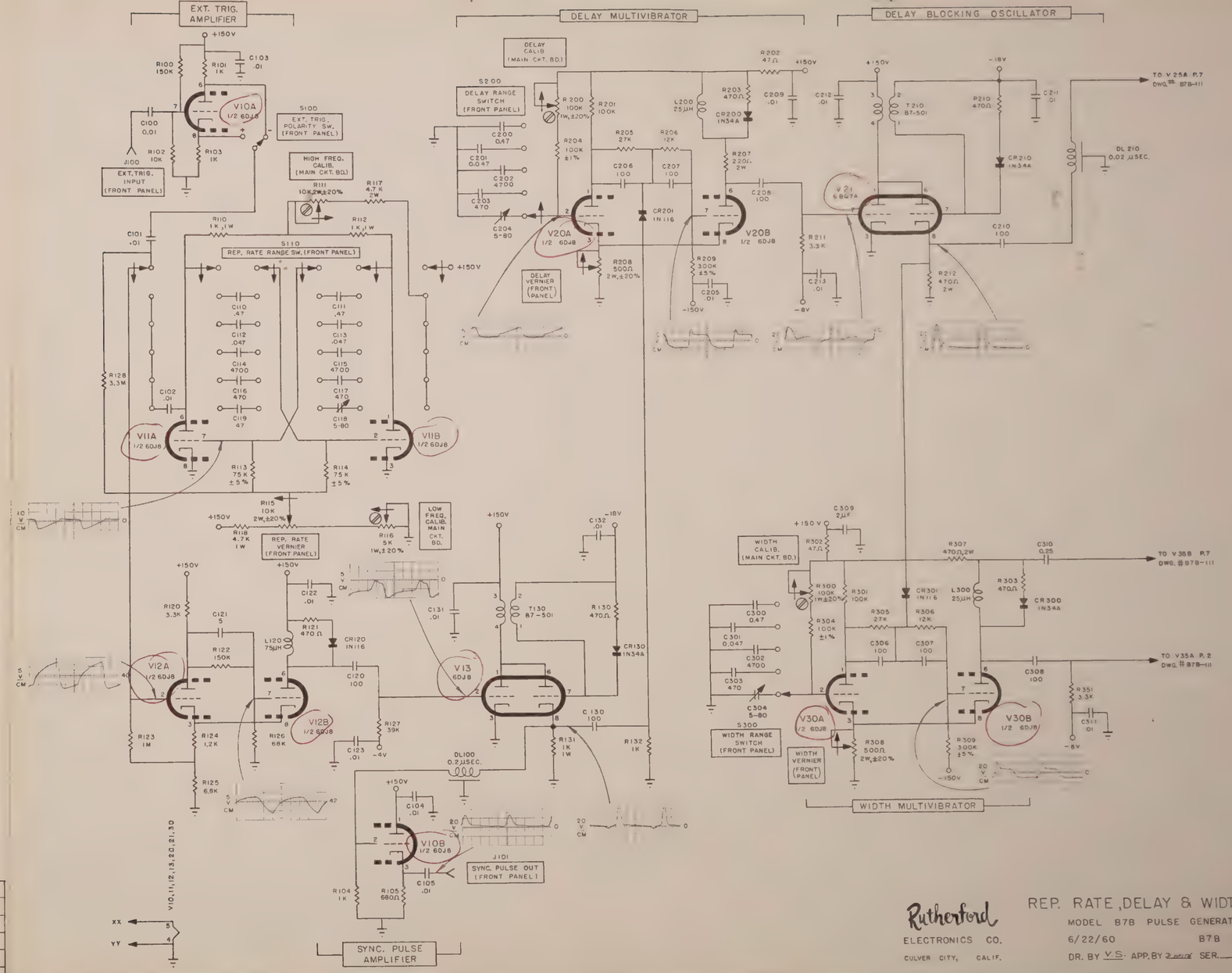
DR. V. S. APP. DW

NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL FIXED RESISTORS ARE 1/2 WATT ±10%
2. ALL CAPACITOR VALUES ONE (1) OR LESS ARE IN MICROFARADS, THOSE GREATER THAN ONE (1) ARE IN MICROMICROFARADS.

WAVEFORMS

PULSE GENERATOR SETTING:	REP. RATE	2 MC
	DELAY	0.1 μSEC
	WIDTH	0.15 μSEC
OSCILLOSCOPE SETTING:	TIME/CM	0.1 μSEC
(TEKTRONIX TYPE 541A)	VOLTS/CM	AS SPECIFIED



LTR	DATE	C.O. NO	BY	APP.
E	6-14-63	R120, 3.3K, WAS 6.8K, C.O. NO 422	V.S.	
D	11-16-62	ADDED R118 C.O. # 406	V.S.	J.M.M.
C	6-14-61	381	V.S.	
B	9-21-60	284	V.S.	
A	8-25-60	282	V.S.	

Rutherford ELECTRONICS CO. CULVER CITY, CALIF.

REP. RATE, DELAY & WIDTH SECT.
MODEL B7B PULSE GENERATOR
6/22/60 B7B 110 E
DR. BY V.S. APP. BY _____ SER. _____

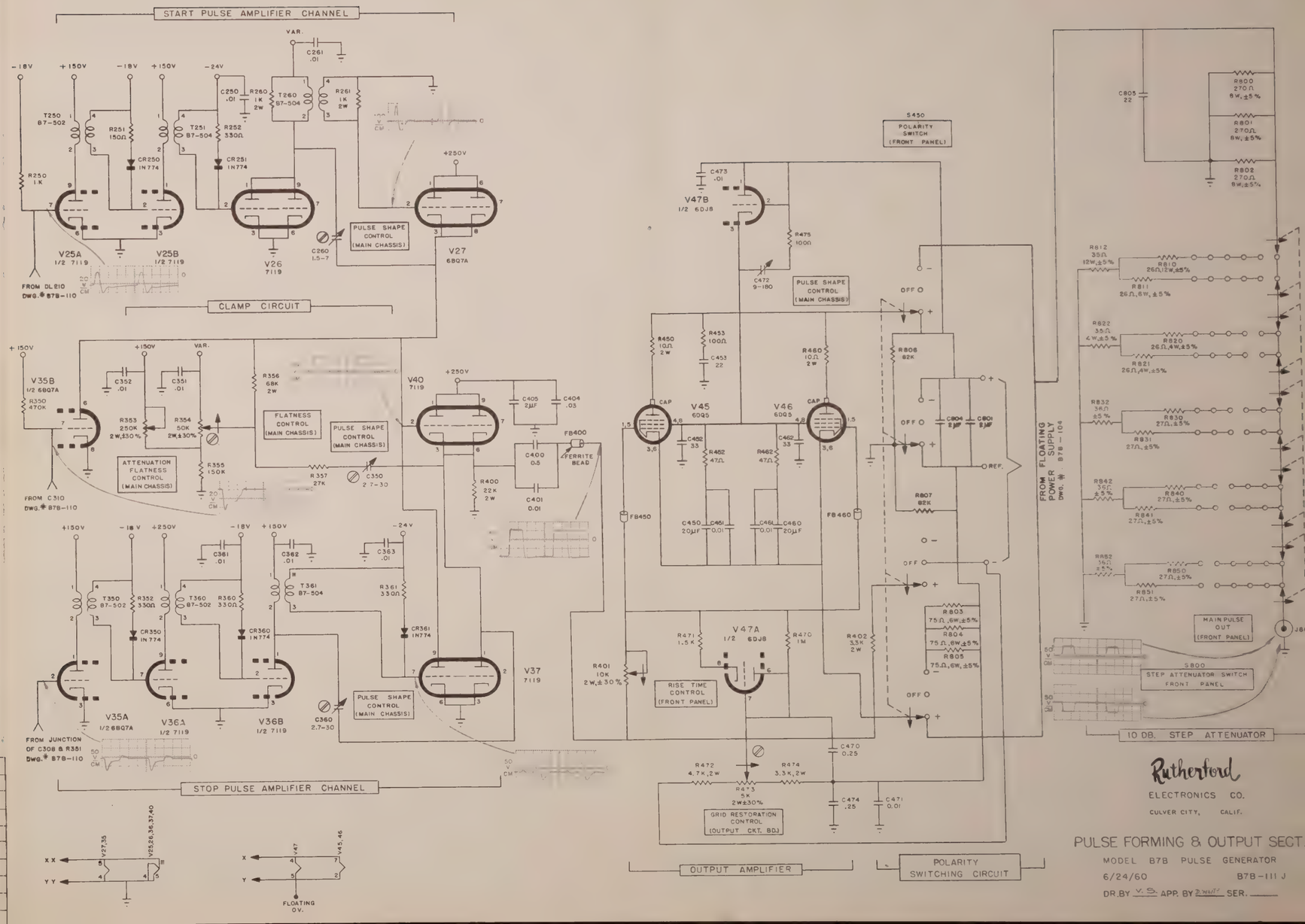
NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL FIXED RESISTORS ARE 1/2 WATT, ±10%.
2. ALL CAPACITOR VALUES ONE (1) OR LESS ARE IN MICROFARADS, THOSE GREATER THAN ONE (1) ARE IN MICROMICROFARADS.
3. POLARITY SWITCH, S450, SHOWN IN THE POSITIVE (+) OUTPUT PULSE POSITION.
4. STEP ATTENUATOR SWITCH, S800, SHOWN IN THE (0) DB. ATTENUATION POSITION.

WAVEFORMS

PULSE GENERATOR SETTING:	REP. RATE	2 MC
	DELAY	0.1 μSEC
	WIDTH	0.15 μSEC
OSCILLOSCOPE SETTING:	TIME/CM	0.1 μSEC
(TEKTRONIX TYPE 541A)	VOLTS/CM	AS SPECIFIED

LTR	DATE	C. O. NO.	BY	APP.
J	2-15-63	C350 & C360 2.7-30 WAS 4-30 C.O. B 418	V.S.	
H	7-16-62	400	V.S.	JM.
G	12-19-61	391	V.S.	
F	6-14-61	381	V.S.	
E	3-21-61	350	V.S.	
D	12-15-60	337	V.S.	
C	9-30-60	287	V.S.	
B	9-21-60	284	V.S.	
A	8-25-60	282	V.S.	



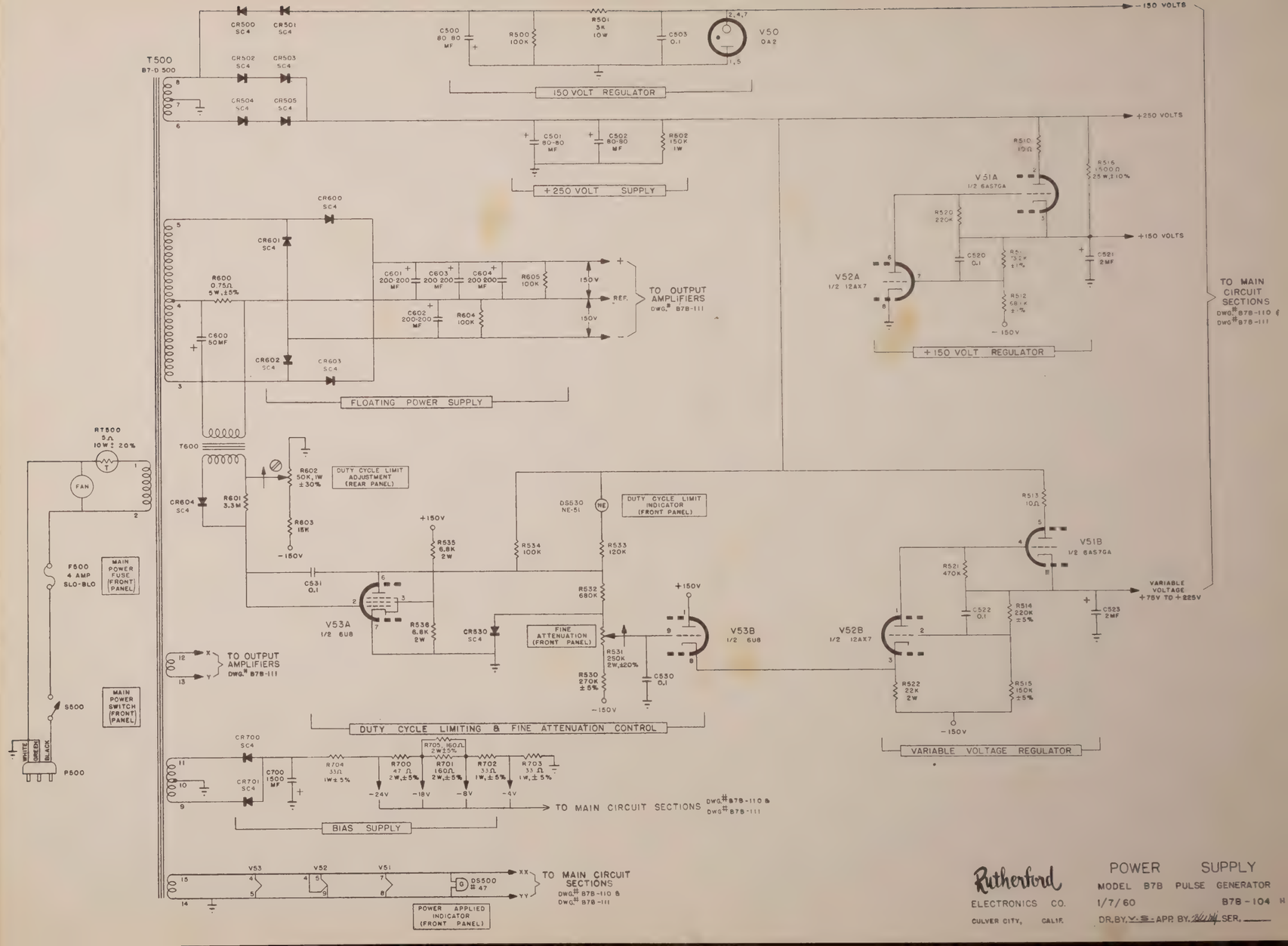
Rutherford
ELECTRONICS CO.
CULVER CITY, CALIF.

PULSE FORMING & OUTPUT SECT.
MODEL B7B PULSE GENERATOR
6/24/60 B7B-111 J
DR. BY V.S. APP. BY [illegible] SER. ____

NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL FIXED RESISTORS ARE 1/2 WATT, ±10%.
2. ALL CAPACITOR VALUES ONE (1) OR LESS ARE IN MICROFARADS, THOSE GREATER THAN ONE (1) ARE IN MICROMICROFARADS.

CH. LTR	DATE	C.O. NO.	BY	APPR.
H	10-31-63	439	E.R.	
G	9-12-63	ADD SC4 TO ALL DIODES, C.O. #425	V.S.	
F	7-16-62	400	V.S.	
E	1-15-62	396	V.S.	
D	8-21-61	387	V.S.	
C	6-14-61	381	V.S.	
B	12-15-60	337	V.S.	
A	8-24-60	282	V.S.	

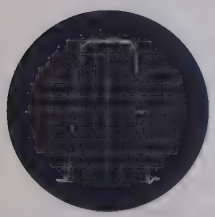


Rutherford ELECTRONICS CO. CULVER CITY, CALIF.

POWER SUPPLY
MODEL B7B PULSE GENERATOR
1/7/60 B7B-104 H
DR. BY V-S APP BY SER.

LOW COST
HIGHLY VERSATILE
GENERAL PURPOSE
COMPACT/PORTABLE
Rutherford PULSE GENERATOR
MODEL B-14

REPETITION RATE - 20 cps to 2 mc
DELAY - 0 to 10,000 μs
WIDTH - .06 to 10,000 μs
AMPLITUDE - 15 V into 1,000 ohms
8 V into 50 ohms
RISE AND FALL TIME - less than 10 ns



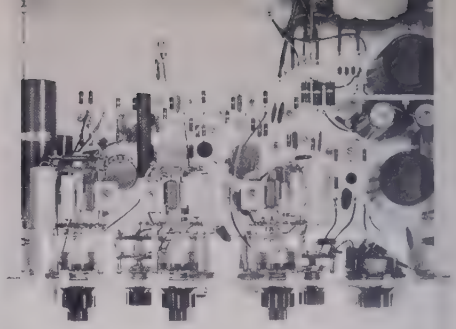
Actual Output Pulse Photographed on Sampling Type Oscillascope With Sweep Rate @ 10 ns per cm.

Featuring . . .

COMPLETELY TRANSISTORIZED
AC OR BATTERY OPERATED
OVERLOAD AND SHORT CIRCUIT PROTECTION. FAST RISE AND FALL TIME.

Rutherford ELECTRONICS CO.
P. O. Box 472 · Culver City, California · TWX 213-836-0407

MODEL B-14
TYPICAL DATA



MAIN OUTPUT PULSE: At front panel BNC connector:

Amplitude: 15 volts minimum into 1000 ohms
8 volts minimum into 50 ohms
2.8 volts minimum into 10 ohms

Amplitude controlled by switched db attenuator plus continuously variable control.

Polarity positive or negative but not simultaneously. Rise and Fall Time less than 10 nsec.

OSCILLATOR REPETITION RATE: The internal oscillator is continuously variable from 20 cycles per second to 2 megacycles in 5 decade ranges.

PULSE DELAY: The main pulse delay is continuously variable in 5 ranges (referred to sync. pulse output):

0.0	microsecond to	1 microsecond
1	microsecond to	10 microseconds
10	microseconds to	100 microseconds
100	microseconds to	1000 microseconds
1000	microseconds to	10,000 microseconds

PULSE WIDTH: The main pulse width is continuously variable in 5 ranges:

0.06	microsecond to	1 microsecond
1	microsecond to	10 microseconds
10	microseconds to	100 microseconds
100	microseconds to	1000 microseconds
1000	microseconds to	10,000 microseconds

OVERSHOOT AND UNDERSHOOT: 5% or less.

DUTY FACTOR: 30% maximum at full output amplitude. Duty factor limiting circuitry automatically reduces output amplitude at higher duty factors. A maximum duty factor of 80% can be achieved at reduced amplitude. Internal circuitry prevents damage with short circuited output.

DROOP:

.06 - 1000 μsec. Pulse width: negligible
1000 - 10000 μsec. Pulse width: 10% maximum

EXTERNAL TRIGGER: To trigger the unit from an external source the following trigger pulse is required at the front panel BNC connector.

Amplitude: 2 V min. to 10 V max.
Rep. Rate: 2 megacycles maximum
Rise time: 1 μsec. or less
Polarity: positive

Delay: Minimum delay is .15 μsec. between external trigger and output pulse.

NOTE: At lower repetition rates and/or faster rise times, the unit triggers with a lower amplitude pulse. The fast rise time of the sync. pulse out allows several Model B-14's to be triggered from the sync. pulse out from one B-14 at all repetition rates.

SYNC. PULSE OUT: A sync. pulse is available at a front panel BNC connector.

Amplitude: 6 V into 1000 ohms
Width: .08 μsec. or wider
Rise time: .05 μsec., approx.
Polarity: positive

SIZE:

Cabinet Model: 12" wide, 5" high, 11½" deep
Rack Mounted: 19" wide, 5¼" high, 11½" deep

WEIGHT: 14 lbs. with batteries, 10 lbs. without batteries. Shipping weights: 19 lbs. with batteries, 14 lbs. without batteries, 5 lbs. battery only.

POWER: 105 - 125 volts AC 50, 60 cycles, 15 watts maximum.

BATTERY: 18.75 volt rechargeable. Battery charger built into unit. From a fully charged battery pack, the unit will operate for approximately 8 hours at 30% duty factor.

PRICE without batteries:

RUTHERFORD Model B-14
Portable Pulse Generator $385.00

RUTHERFORD Model B-14R
Rack Mounted Pulse Generator $405.00

ACCESSORY PRICE:

RUTHERFORD Part J 046
Rechargeable Battery Pack . . . . . $ 75.00

All prices F.O.B. Culver City, Calif. Packed for domestic shipment.

Note: Rep. Rate, Delay and Width controlled by range switch with uncalibrated vernier control to set desired operating point.

All data subject to change without notice.

Printed in U.S.A.

...accurate research starts with RUTHERFORD pulse instrumentation.

Representatives and service in the major cities of the world

Rutherford ELECTRONICS CO.

P. O. Box 472 · Culver City, California
Phone: UPton 0-7393 · TWX: 213-836-0407

pulse generators / pulse systems / accurate time delay generators

Rutherford MODEL B-7F

DOUBLE PULSE GENERATOR

The NEW MODEL B-7F incorporates all of the time-proven specifications of the popular MODEL B-7B . . .

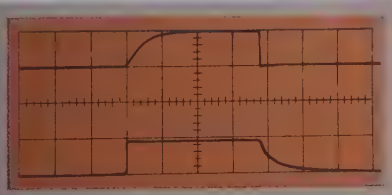
PLUS THREE NEW FEATURES

- **2 cycle/second Repetition Rate**
  Repetition rate is continuously variable from 2 cycles/second to 2 megacycles/second.
- **Separate and Independent Rise and Fall Time Controls**
  The rise or fall time of the output pulse may be independently degraded to approximately 1 μ sec.
- **Double Pulse Output**
  Either single or double pulse output available by front panel control.

Double exposure photograph showing independent degradation of (a) rise time and (b) fall time.

(a)

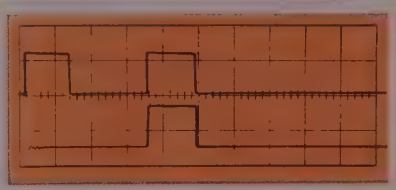
(b)



Double exposure photograph showing (a) double pulse output and (b) single pulse output.

(a)

(b)



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SPECIFICATIONS .... MODEL B-7F

REPETITION RATE:	2 c/s to 2 mc/s, continuously variable in six ranges.
EXTERNAL TRIGGER:	Unit may also be triggered from an external source by a pos. or neg., 20 volt pulse at rep. rates to 2 mc/s. Note: The fast rise time quality of the B-7F sync. pulse allows the triggering of one or more B-7F's from the sync. pulse of a master unit at all rep. rates.
DELAY:	0.0 μ sec. to 10,000 μ sec., continuously variable in five ranges. (Referenced to the sync. pulse.) Note: In the double pulse mode, the first pulse is fixed at approximately zero delay. The second pulse is delayable from 0.5 to 10,000 u sec. with respect to the leading edge of the first pulse.
WIDTH:	0.05 μ sec. to 10,000 μ sec., continuously variable in five ranges. (Measured at the 50% amplitude points.) Note: In the double pulse mode, both output pulses are controlled simultaneously in width.
AMPLITUDE:	50 volts, minimum, into 50 ohms. (both single and double pulse)
DUTY FACTOR:	30%, maximum, at full output amplitude. Automatic limiting circuitry reduces the output amplitude at duty factors greater than 30%. Unit may be safely operated to approx. a 70% duty factor. Output amplitude is approx. 35 volts at 50% duty factor and approx. 20 volts at 70%. In the double pulse mode, duty-factor applies to the sum of both pulse widths.
ATTENUATION:	0 to 60 db. down, continuously variable.
RISE TIME:	0.015 μ sec., or less.
FALL TIME:	0.015 μ sec., or less. Note: Rise and fall time of the output pulse may be independently degraded to approx. 1 μ sec. In the double pulse mode, rise times degrade simultaneously and fall times degrade simultaneously.
POLARITY:	Positive or negative, but not simultaneously.
OVERSHOOT & UNDERSHOOT:	5%, maximum, at full amplitude.
DROOP:	0-100 μ sec. wide pulse — negligible. 100-1,000 μ sec. wide pulse — 15%, max. 1,000-10,000 μ sec. wide pulse — 25%, max.
SYNC. PULSE OUT:	Amplitude — 10 volts, min. Width — 0.05 μ sec., min. Rise time — 0.03 μ sec., max. Polarity — Positive.
SIZE:	19" wide, 8¾" high, 13" deep.
WEIGHT:	Approx. 42 lbs., net 53 lbs., shipping wt.
POWER REQ'D:	115 volts, 3.26 amps., 50-60 c/s, 375 watts.
PRICE:	$920.00 F.O.B. Culver City, California.

All data subject to change without notice.

APC-631 - 1

Rutherford

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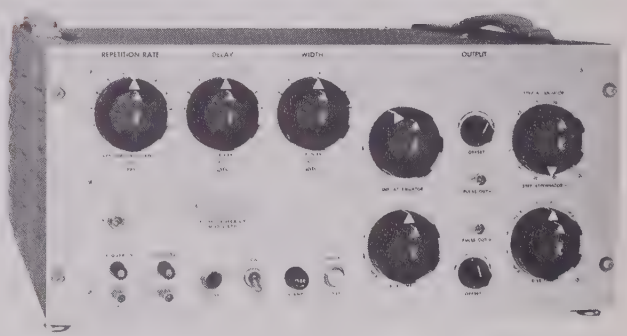
Printed in U.S.A.

Rutherford presents...

THE MODEL B-7D

PULSE GENERATOR



The NEW MODEL B-7D incorporates all of the time-proven specifications of the popular MODEL B-7B . . .

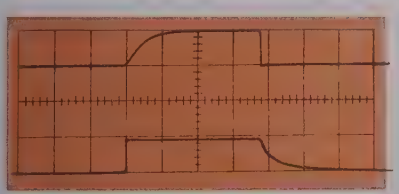
PLUS THREE NEW FEATURES

- **Simultaneous Positive and Negative Output Pulses**
  The two pulses available at front panel connectors are identical in all respects except for being opposite in polarity.
- **Separate and Independent Rise and Fall Time Controls**
  The rise or fall time of either pulse may be degraded without affecting the remaining rise and fall times.
- **DC Level Control on both outputs**
  The DC level of each output may be set to zero, at all duty factors up to 30%, by front panel control.

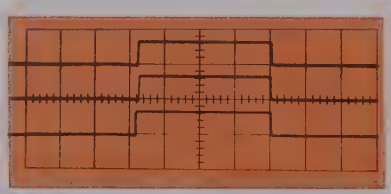
Double exposure photograph showing independent degradation of (a) rise time and (b) fall time.

(a)

(b)



Triple exposure photograph showing the DC level of an output pulse at three different settings.



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SPECIFICATIONS . . . . MODEL B-7D

REPETITION RATE:	20 c/s to 2 mc/s, continuously variable in five ranges.
EXTERNAL TRIGGER:	Unit may also be triggered from an external source by a pos. or neg., 20 volt pulse at rep. rates to 2 mc/s. Note: The fast rise time quality of the B-7D sync. pulse allows the triggering of one or more B-7D's from the sync. pulse of a master unit at all rep. rates.
DELAY:	0.0 μ sec. to 10,000 μ sec., continuously variable in five ranges. (Referenced to the sync. pulse.)
WIDTH:	0.05 μ sec. to 10,000 μ sec., continuously variable in five ranges. (Measured at the 50% amplitude points.)
AMPLITUDE:	50 volts, minimum, into 50 ohms. (both output pulses)
DUTY FACTOR:	30%, maximum, at full output amplitude. Automatic limiting circuitry reduces the output amplitude at duty factors greater than 30%. Unit may be safely operated to approx. a 70% duty factor. Output amplitude is approx. 35 volts at 50% duty factor and approx. 20 volts at 70%.
ATTENUATION:	0 to 60 db. down, continuously variable.
RISE TIME:	0.015 μ sec., or less.
FALL TIME:	0.015 μ sec., or less. Note: Rise and fall time of each output pulse may be independently degraded to approx. 1 usec.
POLARITY:	Positive and negative, simultaneously.
OVERSHOOT & UNDERSHOOT:	5%, maximum, at full amplitude.
DROOP:	0-100 μ sec. wide pulse — negligible. 100-1,000 μ sec. wide pulse — 15%, max. 1,000-10,000 μ sec. wide pulse — 25%, max.
DC LEVEL:	The DC level of each output may be set to zero, at all duty factors up to 30%, by front panel control.
SYNC. PULSE OUT:	Amplitude — .10 volts, min. Width — 0.05 μ sec., min. Rise time — 0.03 μ sec., max. Polarity — Positive.
SIZE:	19" wide, 8¾" high, 18 5/8" deep.
WEIGHT:	Approx. 60 lbs., net 70 lbs., shipping wt.
POWER REQ'D:	115 volts, 3.26 amps., 50-60 c/s, 375 watts.
PRICE:	$1200.00 F.O.B. Culver City, California.

All data subject to change without notice.

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Rutherford

PULSE GENERATOR MODEL B5-A

Precision
PULSE FORMING
and TIMING
INSTRUMENTS

FEATURING:

High Repetition Rate with no greater than 8 Millimicroseconds Rise and Fall Time operating from 1 cps to 10 megacycles.

The Model B5-A, built to the most exacting standards of precision engineering, offers an unparalleled combination of good, clean pulses and high repetition rate and fast rise and fall times. The unit provides an electronic pulse delay that can be set to zero or is continuously variable from .030 microseconds to 500 microseconds in five ranges. Pulse width is continuously variable from .02 to 12.5 microseconds in four ranges.

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SPECIFICATIONS B-5A

MAIN PULSE: PULSE WIDTH: continuously variable from .02 microsecond to 12.5 microseconds (duty factor limited to 20%) in four ranges:

.02 to .1 microsecond
.1 to .5 microsecond
.5 to 2.5 microseconds
2.5 to 12.5 microseconds

AMPLITUDE: 40 volts positive, 45 volts negative.

ATTENUATOR: 60 db in ½ db steps.

RISE AND FALL TIME: no greater than 8 millimicroseconds.

POLARITY: both positive and negative pulses simultaneously available.

OUTPUT IMPEDANCE: 185 ohms (the instrument must be terminated for proper pulse shape).

PERCENT DROOP: no greater than 6%.

SYNCHRONIZING PULSE OUT: 10 volts, positive.

RISE TIME: less than .02 microsecond.

WIDTH: .03 microsecond.

EXERNAL TRIGGER: Pulse Required: 10 volts minimum with rise time less than .05 microsecond.

PULSE REPETITION RATE: Continuously variable from 1 cycle/sec to 10 mc/sec in seven ranges:

1 c to 10 c
10 c to 100 c
100 c to 1 kc
1 kc to 100 kc
10 kc to 100 kc
100 kc to 1 mc
1 mc to 10 mc

DELAY: A fixed delay of .1 microsecond occurs between the synchronizing pulse out and the main pulse.

ELECTRONIC PULSE DELAY: can be set to zero or is continuously variable from 0.030 μsec. to 500 μsecs in 5 ranges.

Note: Pulse delay is limited to approximately 20% of the pulse spacing.

POWER REQUIRED: 105-125 volts, 50-60 cycles, 600 watts.

CONNECTORS:

Sync. Pulse Out—type BNC.
External Trigger—type BNC.
Main Pulse—type C.

DIMENSIONS: 23" high, 23" wide, 16" deep.

WEIGHT: 110 pounds.

ACCESSORIES SUPPLIED

1 unit extension cable.
1 5-ft. output cable (type RG 114/U)
1 185 ohm non-inductive resistor.
1 185 ohm termination assembly.
1 instruction manual.

PRICE: $2,400.00 F.O.B. Culver City, California.

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pulse generators / pulse systems / accurate time delay generators

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Rutherford

HIGH SPEED
10 MEGACYCLE
DOUBLE

PULSE GENERATOR

MODEL B5-2

The model B5-2 is a high speed double pulse generator producing two pulse trains having repetition rates up to ten megacycles per second. Both pulse trains are derived from a single oscillator. Its output pulses are adjustable in width from 20 mμs to 12.5 μs with rise and fall time no greater than 8 mμs. Maximum pulse width is restricted to about 20% of the pulse to pulse spacing. (Duty cycle .20 or less). Both pulses may be delayed individually up to 500 μs by using delay-multivibrator type circuit. Pulse delay can not exceed 20% of pulse spacing. In a special delay unit, by means of coaxial delay lines, one of the two main output pulses can be delayed up to .4 μs in steps of .005 μs without any further restrictions. Continuously variable repetition rate, pulse width and pulse delay permit the study of high speed switching circuits.

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P.O. BOX 472 • Culver City, California •

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SPECIFICATIONS B5-2

MAIN PULSE: PULSE WIDTH: continuously variable from 20 mμs to 12.5 μs in four ranges:

20 to 100 mμs
100 to 500 mμs
.5 to 2.5 μs
2.5 to 12.5 μs

Note: Pulse width not to exceed 20% of the pulse to pulse spacing. Attempting to exceed this limitation will result in the output pulse occurring at a repetition rate that is a sub-multiple of the oscillator setting.

AMPLITUDE: 40 volts positive, 45 volts negative.

ATTENUATOR: 60 db in ½ db steps.

RISE AND FALL TIME: no greater than 8 millimiscroseconds.

POLARITY: both positive and negative pulses simultaneously available.

OUTPUT IMPEDANCE: 185 ohms (the instrument must be terminated for proper pulse shape).

PERCENT DROOP: no greater than 6%.

SYNCHRONIZING PULSE OUT: 10 volts, unloaded at 180 ohms output impedance.

RISE TIME: less than 20 millimicroseconds.

WIDTH: .03 microsecond.

EXTERNAL TRIGGER: 10 volts minimum with rise time of less than .1 μs for triggering the oscillator from an external source. The quality of the sync. pulse out is such that it may be used to trigger an additional B5-2 at all rep. rates.

PULSE REPETITION RATE: continuously variable from 1 cycle/sec to 10 mc/sec in seven ranges:

1 c to 10 c
10 c to 100 c
100 c to 1 kc
1 kc to 100 kc
10 kc to 100 kc
100 kc to 1 mc
1 mc to 10 mc

DELAY: a fixed delay of .1 microsecond occurs between the synchronizing pulse out and the main pulse.

ELECTRONIC PULSE DELAY: can be set to zero or is continuously variable from 0.030 μsec. to 500 μsecs in 5 ranges.

Note: Pulse delay is limited to approximately 20% of the pulse spacing.

185 OHM DELAY LINE PULSE DELAY: is established by using different lengths of RG 114/U coaxial cable. This kind of delay does not have any restrictions to the amount of delay with respect to pulse to pulse spacing. Seven different cable lengths can set up any delay up to .4 microseconds in .005 microsecond steps: .005 μs, .01 μs, .02 μs, .02 μs, .05 μs, .1 μs, and .2 μs.

POWER REQUIRED: 105-130 volts, 50-60 cycles, 625 watts.

VENTILATION: filtered forced air.

CONNECTORS:

Sync. Pulse Out—type BNC.
External Trigger—type BNC.
Main Pulse—type C.

DIMENSIONS: 48" high, 23" wide, 21" deep.

WEIGHT: 210 pounds.

ACCESSORIES SUPPLIED:

2 five ft. output cables
2 terminations 185
2 terminating resistors
1 instruction manual

PRICE: $3,975.00 F.O.B. Culver City, California.

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Bulletin N

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with RUTHERFORD
pulse instrumentation

pulse generators • pulse systems • accurate time delay generators

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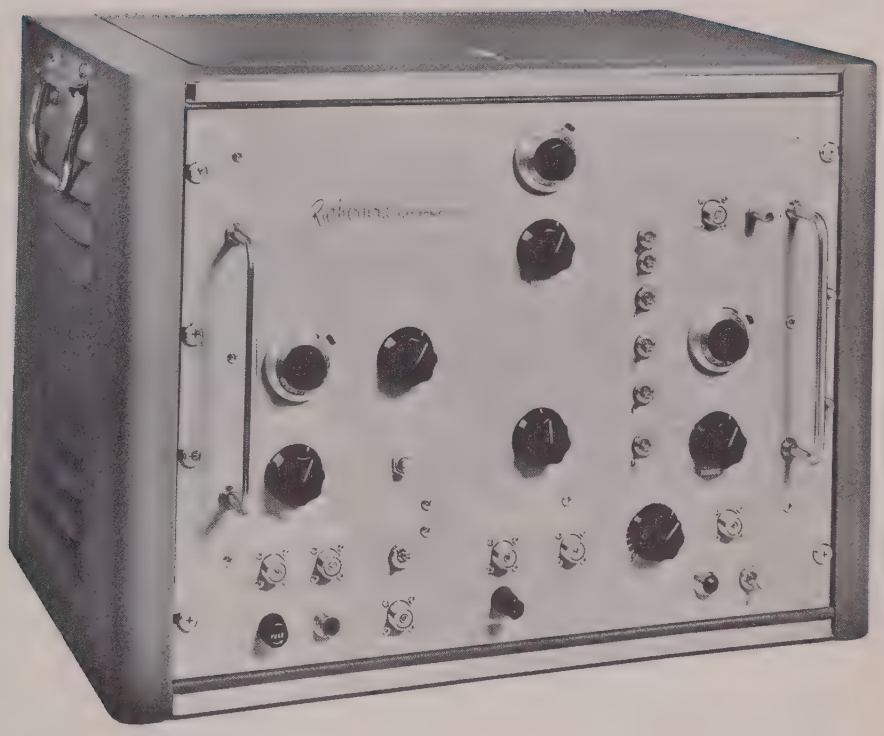
BULLETIN B-2A

PULSE GENERATOR



MODEL B-2A
PULSE GENERATOR

A general purpose instrument which produces pulses of accurately controlled widths, amplitude and time delay at low impedance.

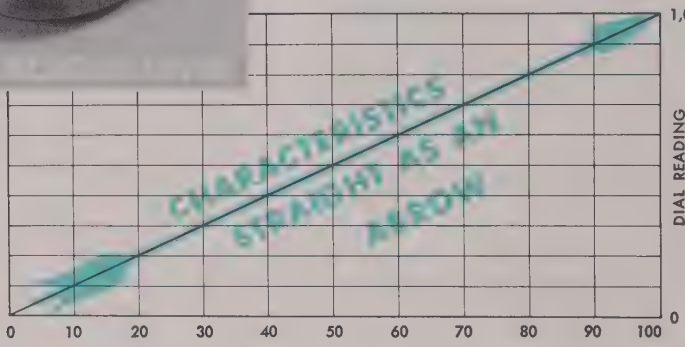
FEATURES

- Internal oscillator gives repetition rates from 10 cycles to 100 kc.
- Pulse widths from .1 μs to 1000 μs.
- Rise time of .02 μs.
- Internal delays to 10,000 μs.
- Accurate, easily legible multiturn controls.
- Superior stability.
- Can be triggered externally and for single pulse operation.
- Calibrating potentiometers are provided for each range.
- Five synchronizing pulses at various time intervals during single repetition period.
- 40 volts output into 93 ohm load.

Rutherford ELECTRONICS CO.
UPTON 0-7393 TWX - 213-836-0407
P. O. BOX 472
CULVER CITY, CALIFORNIA

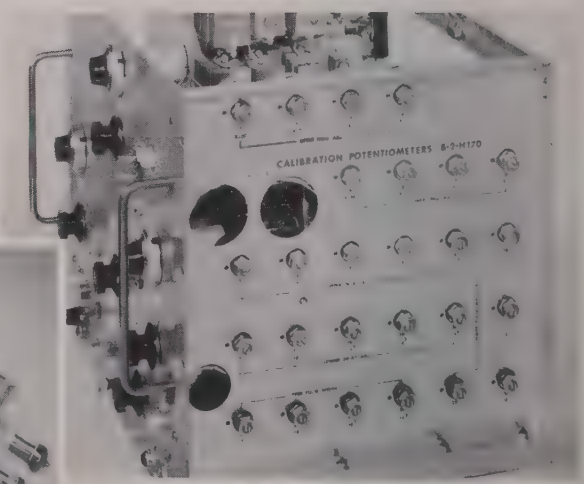
Here is a more graphic presentation of a few of the many features of design, assembly and performance which make this a most desirable new tool for the Electronic Engineer and Research Scientist.

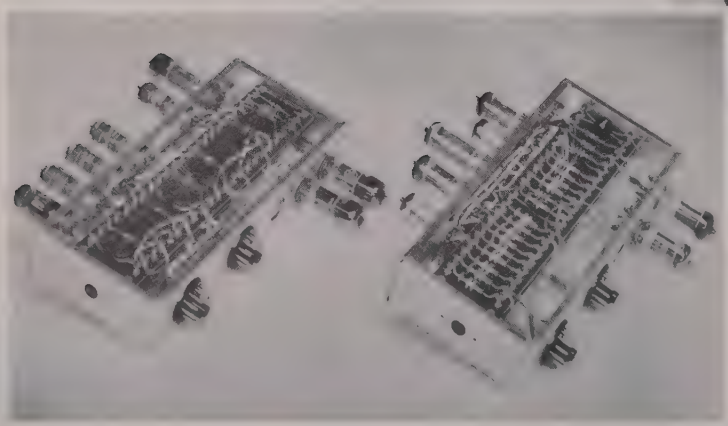
Helical potentiometers and ten-turn counting dials facilitate setting of controls. These dials and potentiometers are used on the repetition rate control, pulse delay control and pulse width control. They are direct reading—require no calibration charts.



The B-2A Pulse Generator, in common with the other precision instruments in the Rutherford line, features linear calibration of the three main controls.

Each range (repetition rate, delay or pulse width) is equipped with two calibrating potentiometers to adjust dial readings accurately.

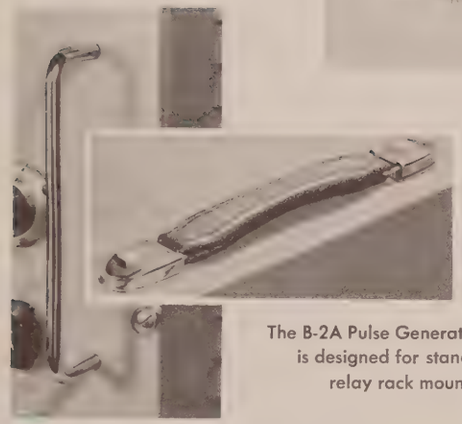




Plug-in construction simplifies maintenance—permits ready access to the many components. Units are easily replaceable for modification.

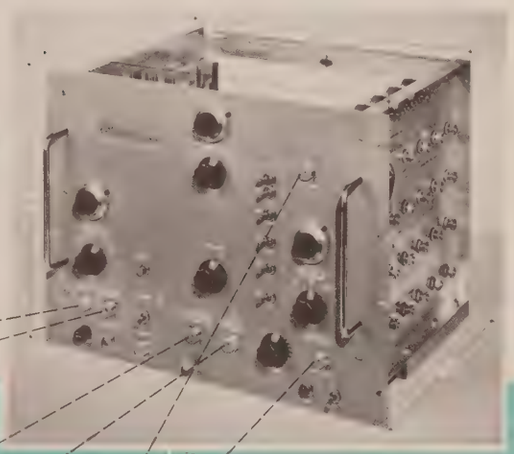
ENGINEERED FOR ACCURACY, VERSATILITY AND CONVENIENCE

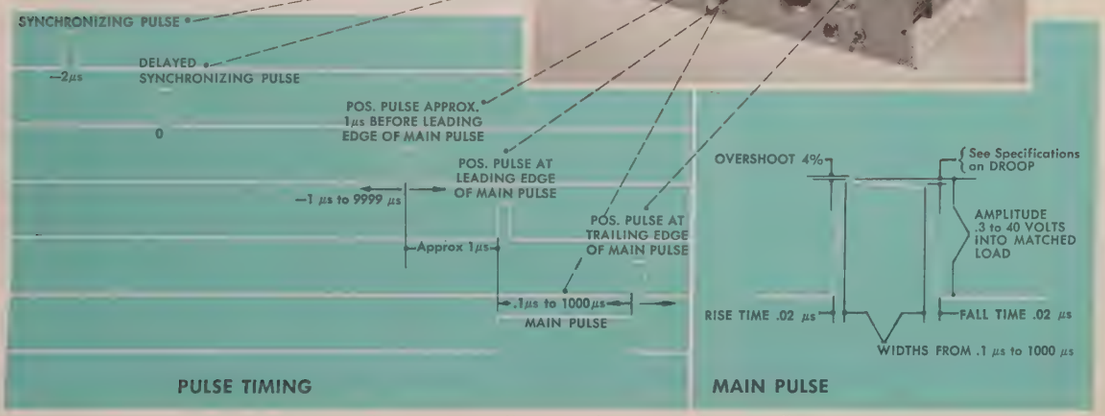
High-vacuum tubes exclusively are used in the pulse forming circuits—permitting high repetition rates and giving freedom from jitter.



The B-2A Pulse Generator is designed for standard relay rack mounting.

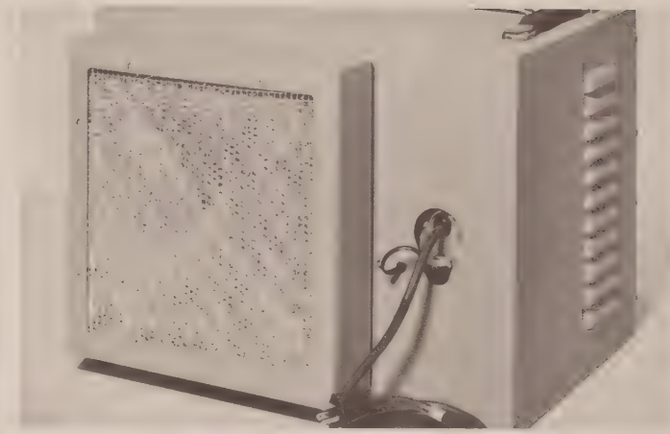
Carrying handles are provided on the top of the case and on the front panel of the B-2A Pulse Generator.




SYNCHRONIZING PULSE
DELAYED SYNCHRONIZING PULSE
—2μs
POS. PULSE APPROX. 1μs BEFORE LEADING EDGE OF MAIN PULSE
0
POS. PULSE AT LEADING EDGE OF MAIN PULSE
—1 μs to 9999 μs
POS. PULSE AT TRAILING EDGE OF MAIN PULSE
Approx 1μs
.1μs to 1000μs
MAIN PULSE
PULSE TIMING
OVERSHOOT 4%
See Specifications on DROOP
AMPLITUDE .3 to 40 VOLTS INTO MATCHED LOAD
RISE TIME .02 μs
FALL TIME .02 μs
WIDTHS FROM .1 μs to 1000 μs
MAIN PULSE

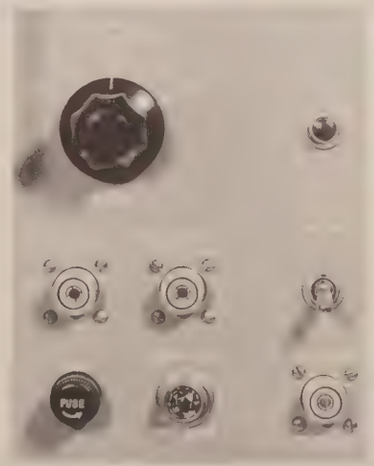
The B-2A Pulse Generator offers 5 synchronizing pulses as well as a main output pulse. The time relationship of the main pulse is variable with respect to the initial and delayed synchronizing pulses.

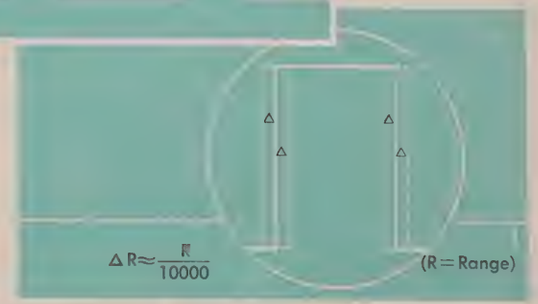
A 50 db step attenuator plus a fill-in attenuator is provided—also a built-in terminating resistor.



High capacity cooling fan assures cool operation of instrument.

The main output pulse can be widened to a 25% duty factor.





The delay (as well as the pulse width and repetition rate) may be varied in increments of 1/the number of convolutions of the helical potentiometers. Inherent jitter of the system is low.

Numerous additional details of design, engineering and assembly contribute to the accuracy, convenience, versatility and exceptional performance of this instrument.

Rutherford ELECTRONICS CO.
UPTON 0-7393 TWX - 213-836-0407
P. O. BOX 472
CULVER CITY, CALIFORNIA

FOR THE ELECTRONIC ENGINEER AND RESEARCH SCIENTIST

SPECIFICATIONS
PULSE GENERATOR
MODEL B-2A

INTERNAL OSCILLATOR:

Ranges: 100 kc to 10 kc
10 kc to 1 kc
1 kc to 100 cycles
100 cycles to 10 cycles

Dial Calibration: 900 divisions per range

Accuracy: ±2% except on 10 kc to 100 kc range

Incremental Frequency: limited by the number of convolutions of the helical potentiometer

Single Pulse: switch produces step function to give a single pulse at each of the outputs

EXTERNAL TRIGGER INPUT:

Can be triggered from a pulse of 2 volts minimum, with a rise time of 2 microseconds, 0 to 100 kc; or a 2-volt RMS sine wave, 60 cps to 100 kc.

SYNCHRONIZING PULSES:

POSITIVE SYNCHRONIZING PULSE:

Blocking oscillator pulse output through a cathode follower

Amplitude: open circuit—at least 20 volts

Rise Time: .2 microsecond

Width: approximately .5 microsecond

Internal Impedance: from cathode follower with 1,000 ohms cathode resistor. External resistor for half amplitude: 470 ohms

Blocking condenser: .01 mfd at 500 volts

POSITIVE DELAYED SYNCHRONIZING PULSE:

Blocking oscillator pulse output through a cathode follower, separated from Positive Synchronizing Pulse by approximately 2 microseconds

Amplitude: open circuit—at least 12.5 volts

Note: Refer to Positive Synchronizing Pulse for characteristics

POSITIVE SYNCHRONIZING PULSE APPROXIMATELY 1 MICROSECOND BEFORE MAIN PULSE:

Blocking oscillator pulse output through a cathode follower

Note: Refer to Positive Synchronizing Pulse for characteristics

Synchronizing Pulses—continued

POSITIVE PULSE AT LEADING EDGE OF MAIN PULSE:

Blocking oscillator pulse output through a cathode follower

Amplitude: open circuit—at least 15 volts

Note: Refer to Positive Synchronizing Pulse for characteristics

POSITIVE PULSE AT TRAILING EDGE OF MAIN PULSE:

Blocking oscillator pulse from cathode of blocking oscillator

Note: Refer to Pos. Sync. Pulse for characteristics

Note: Loading this output increases the fall time of the main pulse

INTERNAL DELAY:

Range: When internally triggered—measured from 50% point of internally generated trigger (Positive Delayed Synchronizing Pulse) to 50% point of output pulse:

0 to 1 microsecond
.5 to 10 microseconds
1 to 100 microseconds
10 to 1,000 microseconds
100 to 10,000 microseconds

When externally triggered, if the external trigger is to be used as reference, allowance must be made for the time interval between rise of external pulse and the Positive Delayed Synchronizing Pulse. This time interval is approximately 2 microseconds

Incremental Delay; limited by the number of convolutions of the helical potentiometer

Linearity: 1% between .1 full scale and .9 full scale, except on 0 to 1 microsecond scale

Duty Factor Effects: minimum recovery time: 1.5 microseconds. Error due to high duty factors—here is a representative table for 1,000 microsecond range:

Duty Factor	% Error
.5%	0 reference
5. %	.1%
50. %	.4%
90. %	3.2%
95. %	5. %
97. %	5.5%

This does NOT imply that the error will be the same for all ranges with the same duty factor

ADDITIONAL DATA INSIDE

Rutherford ELECTRONICS CO.
UPTON 0-7393 TWX - 213-836-0407
P. O. BOX 472
CULVER CITY, CALIFORNIA

SPECIFICATIONS—continued
PULSE GENERATOR
MODEL B-2A

Internal Delay—continued

Jitter: .01%

Accuracy: after calibration: ±1%;
long term: ±2%

Note: Except on 1 microsecond range and below .1 full scale reading

Dial Calibration: 1,000 divisions for each range

MAIN PULSE:

Width Ranges: .06 to 1 microsecond
.5 to 10 microseconds
1. to 100 microseconds
10. to 1,000 microseconds

Accuracy: after calibration: ±1%;
long term: ±2%

Note: Except on 1 microsecond range and below .1 full scale reading

Linearity: 1% between .1 full scale and .9 full scale, except on .1 to 1 microsecond scale

Jitter of Trailing Edge with respect to Leading Edge: .01%

Incremental Change in Width: limited by the number of convolutions of the helical potentiometer

Dial Calibration: 1,000 divisions

Duty Factor: limited by current capabilities of the output tube to 25%

Amplitude: at least 40 volts into 93 ohm load

Impedance: 93 ohm maximum

Rise Time: .02 microsecond between 10% and 90% points

Fall Time: .02 microsecond

Overshoot and Undershoot: less than 4% with matched load

Top of Pulse (excluding overshoot):

$$\%\ \text{Droop} = \frac{(\text{Pulse Amplitude})_{(\text{Leading Edge})} - (\text{Pulse Amplitude})_{(\text{Trailing Edge})}}{(\text{Pulse Amplitude Leading Edge})} \times 100$$

Droop can be adjusted to less than 5%

Polarity of Main Output Pulse: plus or minus—but NOT simultaneously

ATTENUATOR:

Step Attenuator: constant impedance—five Pi sections with 10 db steps

Fill-in Attenuator: 10 db variable

CONTROLS:

On-Off (Power)
Single Pulse Switch
Delay Range
Delay Dial
Repetition Rate Dial
Pulse Width Range
Pulse Width Dial
Amplitude Fine Control
Attenuator In-Out Switches
Main Pulse Switch
Repetition Rate Range—External
Trigger Sensitivity

INDICATING LAMPS:

Pilot Light
Blown Fuse Indicator

CONNECTORS:

Inputs and Outputs: S0239 (Video type) (may be fitted with UG-273/U adaptors for BNC connectors)

Power Connector: Six-foot cord with NEMA plug with grounding pin and parallel blades

POWER:

110 volts—50-60 cycles, or 220 volts—50-60 cycles; 400 watts. Units are delivered connected for 110 volt operation

SIZE:

Mounts on standard rack: 14" high x 19" wide

Supplied with cabinet 14" x 19" x 16½" exclusive of front panel handles

WEIGHT:

64 pounds

ACCESSORIES SUPPLIED:

Four plug-in extension cables
One instruction manual

CALIBRATION:

Each range on Repetition Rate, Delay, and Pulse Width may accurately be calibrated by use of separate potentiometer adjustments. These potentiometers change only a DC voltage level which does not involve signals

ADDITIONAL SPECIFICATIONS

B2A-631 - 2.5M PRINTED IN U.S.A.

DATA SUBJECT TO CHANGE WITHOUT NOTICE

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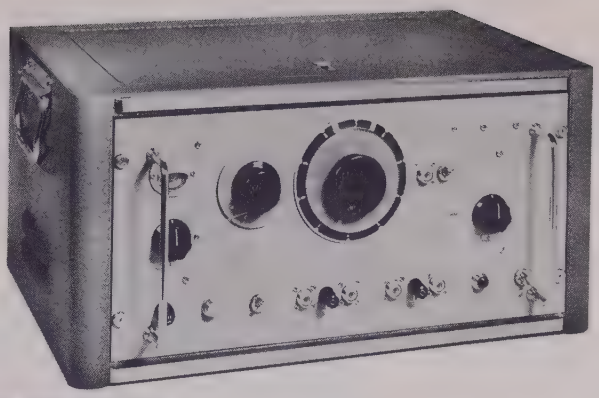
UPTON 0-7393 TWX - 213-836-0407
P. O. BOX 472
CULVER CITY, CALIFORNIA

MODEL A-2



MODEL A-4

TIME DELAY GENERATORS

ATIONS OF RUTHERFORD MODEL A-2 DELAY GENERATOR

bration of synchroscopes... measurement of radar range... ulation of radar range... simulation of moving targets (with liary equipment)... delaying synchroscope sweeps... produc- of accurately spaced pulses for biological investigations... surement of waveform timing... measurement of time delays measurement of pulse width... to replace internal delay cir- s of pulse generators when a more accurate delay is required testing the resolving time of counters (with auxiliary equipment) measurement of sonar range

Rutherford ELECTRONICS CO.

P. O. BOX 472

CULVER CITY, CALIFORNIA

TELEPHONE UPton 0-7393

TWX - 213-836-0407

SPECIFICATIONS

MODEL A-2

DELAY RANGES:

.8 to 100,000 microseconds. In five decade ranges

INCREMENTAL DELAY:

Limited by the resolution of the helical potentiometer control to 1/9800 of full scale.

JITTER:

.01 microsecond or .008%, whichever is greater.

ACCURACY:

After calibration: ±.1% of full scale.

Long term: ±1% of full scale.

LINEARITY:

.3% or better between .1 full scale and full scale (except on .8 to 10 microsecond range).

INPUT:

Amplitude:

15 volts min., 60 volts max. pulse.

30 volts RMS 100 cycle sine wave min., 60 volts max.

Blocking Condenser:

for 400 volts.

Impedance:

20 mmfd and 470,000 ohms.

DIAL CALIBRATION:

1000 divisions, each approximately ⅛ inch wide.

ATA SUBJECT TO CHANGE WITHOUT NOTICE.

o. A2-631 - 5M

Printed in U.S.A.

OUTPUT PULSES:

BLOCKING OSCILLATOR

Width: .5 microsecond wide between 10% points, approx.
Rise Time: .1 microsecond between 10% and 90% points.
Output Impedance: 100 ohms (.01 mfd blocking condenser).
Amplitude: 50 volts, open-circuited.

MULTIVIBRATOR

Widths approximately as per table below. For presentation on synchroscope.

Range	Width
10 microseconds	5 microseconds
100 microseconds	10 microseconds
1,000 microseconds	30 microseconds
10,000 microseconds	100 microseconds
100,000 microseconds	400 microseconds

Output Impedance: 500 ohms (.1 mfd blocking condenser).
Amplitude: 35 volts, open-circuited.

EXTERNAL DELAY VOLTAGE:

150 to 50 volts... zero to full delay.

REPETITION RATE EFFECTS:

The error introduced by repetition rate changes is a function of the percent duty factor. A representative table of duty factor effects for 1,000 microsecond scale is shown below:

Duty Factor	Error
.5%	0 (reference)
5%	.1%
50%	.4%
90%	3.2%
95%	5%
97%	5.5%

The duty factor must be limited to allow at least 3 microseconds recovery time.

EFFECT OF LINE VOLTAGE VARIATIONS:

Variations from 105 volts to 125 volts changes the delay by .15%.

INDICATING LAMPS:

Pilot light (on-off): Blown fuse.

INDICATOR TUBE:

"Magic Eye" tube type 6E5 to indicate coincidence of delayed pulse and calibrating pulse.

POWER:

105-125 volts, 50-60 cycles, 140 watts.

SIZE:

Mounts on standard 8¾"x 19" relay rack panel. Chassis is 13" deep. With dust cover is 10½" high, 22¼" wide and 14⅞" deep overall, including front panel protective handles.

WEIGHT: 53 pounds

ACCESSORIES SUPPLIED: Instruction book

PRICE: $750.00 F.O.B. Culver City.

SPECIFICATIONS

MODEL A-4

Basically the same as Model A-2 except as follows:

DELAY RANGES:

.00001 to 10 seconds. In five decade ranges

INTERNAL OSCILLATOR:

RANGES:

1,000 cps to 100 cps
100 cps to 10 cps
10 cps to 1 cps
1 cps to .1 cps

MULTIVIBRATOR

Widths approximately as per table below. For presentation on synchroscope.

Range	Width
.001 second	30 microseconds
.01 second	100 microseconds
.1 second	500 microseconds
1. second	5,000 microseconds
10. second	50,000 microseconds

Output Impedance: 500 ohms (1 mfd blocking condenser).
Amplitude: 35 volts.

TRIGGER

Same as blocking oscillator.

PRICE:

$875.00 F.O.B. Culver City.

Other Rutherford instruments you might find useful in your laboratory:

1. High Repetition Rate Pulse Generators
2. Precision Time Delay Generators
3. General Purpose Pulse Generators
4. Versatile Modular Construction Pulse Generator
5. Special Design Pulse Instrumentation
6. 10 Megacycle Pulse Generators
7. Highly Accurate Pulse Generators
8. Variable Rise Time Generators
9. Low Jitter Pulse Generators
10. Multiple Pulse and Pulse Code Generators
11. Pulse Systems

Rutherford

ALL PURPOSE PULSE GENERATOR

FOR AS LOW AS

$385.*

MODEL B-14

The Model B-14 is a precise, compact instrument designed for both laboratory and field application. The unit features a self-contained, rechargeable battery pack to permit portable use. It is completely transistorized with printed circuit board construction and incorporates many other advanced engineering features.

Some of the outstanding specifications are:

Repetition rate: continuously variable from 20 cycles/second to 2 megacycles/second in five ranges.

Delay: from 0 to 10,000 μs in five ranges.

Width: from .06 to 10,000 μs in five ranges.

Maximum pulse amplitude: 15V into 1000 ohms and 8V into 50 ohms.

Rise and fall time: less than 10 ns.

Dimensions: 12" wide x 5"high x 11½" deep.

Weight: 14 lbs.

***Price $385.00 (excluding batteries) F.O.B. Culver City, California.**

For complete specifications, write to Dept. R

Representatives and service in the major cities of the world

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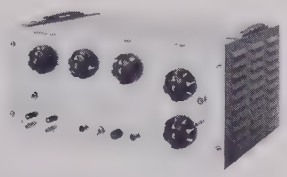
pulse generators / pulse systems / accurate time delay generators

A NEW DIMENSION IN PULSE INSTRUMENTATION

Rutherford

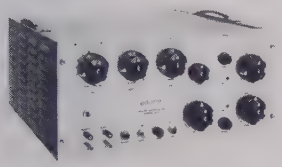
MODEL B-7B

HIGH PERFORMANCE · WIDE VERSATILITY
ALL PURPOSE PULSE GENERATOR



FEATURING...TIME PROVEN SPECIFICATIONS
50 volts into 50 ohms @ 30% duty factor. Repetition Rate to 2 mc/s, continuously variable in five ranges. Width .05 μsec. to 10,000 μsec., continuously variable in five ranges. Delay from 0.0 μsec. to 10,000 μsec., continuously variable in five ranges. Rack mountable, single unit construction. Price $720.00, F.O.B. Culver City, Calif.

MODEL B-7D



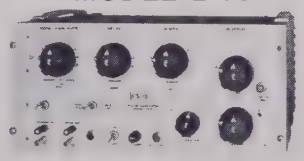
...incorporates all the time proven specifications of the popular MODEL B-7B

PLUS THREE NEW FEATURES

Simultaneous Positive and Negative Output Pulses. Separate and Independent Rise and Fall Time Controls—The rise or fall time of either pulse may be degraded without affecting the remaining rise and fall times. DC Level Control—The DC component of each output may be set to zero, at all duty factors up to 30% by front panel control.

Price $1,200.00, F.O.B., Culver City, Calif.

MODEL B-7F



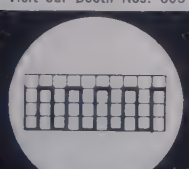
...incorporates all the time proven specifications of the popular MODEL B-7B

PLUS THREE NEW FEATURES

Continuously variable repetition rate from 2 cycles/sec. to 2 megacycles/sec. Separate and Independent Rise and Fall Time Controls—The rise and fall time of the output pulse may be independently degraded to approximately 1 μsec. Either single or double pulse output is available by front panel control.

Price $920.00, F.O.B. Culver City, Calif.

Visit our Booth Nos. 603 and 604, Wescon Show, or for complete specifications...write to Dept. EDN762



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Rutherford ELECTRONICS CO.

P. O. Box 472, Culver City, California

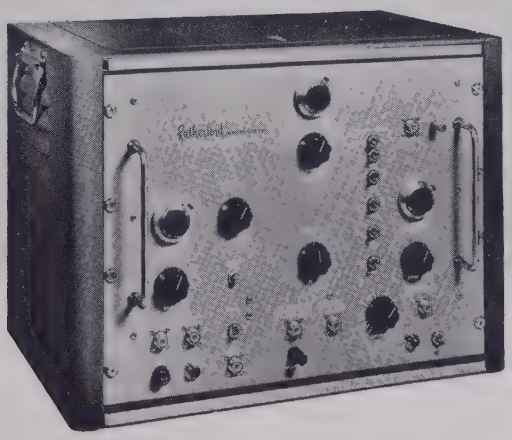
pulse generators / pulse systems / accurate time delay generators

A GENERAL PURPOSE

PULSE GENERATOR

THAT OFFERS FIVE SYNCHRONIZING PULSES...PLUS A MAIN OUTPUT PULSE WITH AN.....

ACCURACY OF 1%



Rutherford model B-2A

Featuring...

- Internal oscillator gives repetition rates from 10 cycles to 100 kc.
- Pulse widths from .1 μs to 1000 μs.
- Rise time of .02 μs.
- Internal delays to 10,000 μs.
- Accurate, easily legible calibrated controls.
- Can be triggered externally.
- Can be operated in the single pulse mode.
- Calibrating potentiometers are provided for each range.
- 40 volts output into 93 ohm load.

For complete specifications, write to Dept. ED 763.

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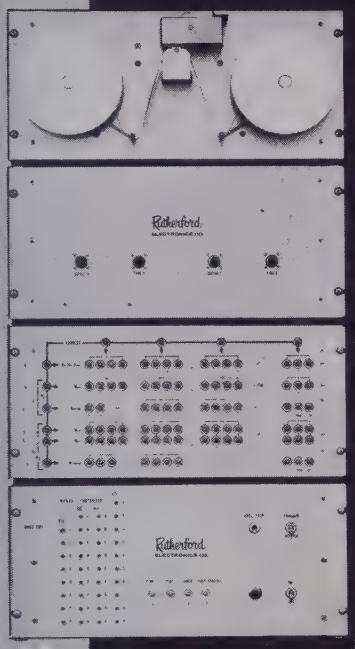
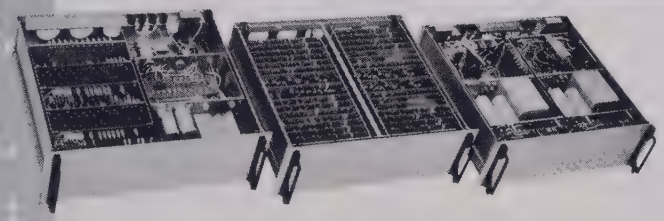
pulse generators / pulse systems / accurate time delay generators

Rutherford

REMOTELY PROGRAMMABLE PULSE and TIME DELAY GENERATORS



. . . Designed to be programmed from punched tapes, cards, or direct computer inputs. 50 volt output pulses, into 50 ohm load, may be obtained with rise and fall times as fast as 10 nanoseconds.



The generators are completely programmable in rep. rate, delay, width, amplitude, and polarity. Operating from a 10mc. crystal clock frequency, rep. rate interval, delay, and width may be programmed in 0.1 μsec. intervals from 0.1 μsec. to as long as required. Smaller incremental divisions (0.01 μsec.) may be obtained through the use of delay line circuitry. Various information decoding methods may be utilized to accept programming information from nearly any source. The system features modularized construction on individual plug-in printed circuit cards. Both commercial and militarized versions are offered.

Visit our Wescon Booth No. 2111-2112.

For complete speciications, write to

Rutherford ELECTRONICS CO.

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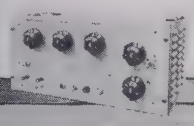
pulse generators / pulse systems / accurate time delay generators

Rutherford "off the shelf" precision pulse instruments

THE INDUSTRY STANDARD · ALL PURPOSE PULSE GENERATORS

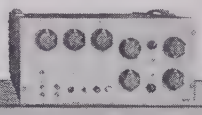
MODEL
B-7B

Specifications: 50 V into 50 ohms @ 30% duty factor. Rep. Rate: 2 mc/s, continuously variable in 5 ranges. Width: .05 μsec. to 10,000 μsec., continuously variable in 5 ranges. Delay: 0.0 μsec. to 10,000 μsec., continuously variable in 5 ranges. Rack mountable, single unit construction. Price $720.00.*



MODEL
B-7D

Specifications: Incorporates all the time proven specifications of MODEL B-7B PLUS . . . simultaneous positive and negative output pulses. Separate and independent rise and fall time controls—the rise or fall time of either pulse may be degraded independently. Adjustable D.C. resting level control. Price $1,200.00.*



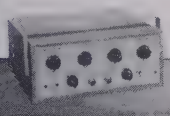
MODEL
B-7F

Specifications: Incorporates all the time proven specifications of MODEL B-7B PLUS . . . double or single pulse output at a flick of the switch. Continuously variable repetition rate from 2 cycles/sec. to 2 mc/sec. Separate and independent rise and fall time controls. Price $920.00.*

MODEL
B-14

COMPACT/PORTABLE
self-contained rechargeable battery pack—transistorized with circuit board construction.

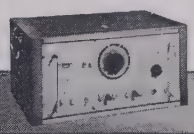
Specifications: Rep. rate: 20 cps to 2 mc. Delay: 0 to 10,000 μs. Width: .06 to 10,000 μs. Amplitude: 15 V into 1,000 ohms, 8 V into 50 ohms. Rise Time: 10 ns (max.). Size: 12″ W x 5″ H x 11½″ D. Weight: 10 lbs. Price $385.00* (excluding batteries).



MODEL
A-2

TIME DELAY GENERATOR

Extreme accuracy. After calibration: ±.1% of full scale. Long term: ±1% of full scale. Features: .8 to 100,000 μsec. in 5 decimally related ranges. Low jitter, linear scales, small repetition rate effects, external connector provided for delay voltage so that unit may be externally time modulated. Price $750.00.*



...AND OTHER Rutherford MODELS ARE AVAILABLE TO MEET YOUR SPECIFIC PULSE REQUIREMENTS

*prices F.O.B. Culver City, Calif.

Rutherford offers a complete line of pulse generators, time delay generators and programmable pulse or delay generators to meet the exacting needs of your specific requirements. The popular instruments, illustrated above, are maintained in stock to accommodate our customers. For price and delivery information, write to: Dept. ED563.

Rutherford
ELECTRONICS CO.

P. O. Box 472 · Culver City, California
Phone: UPton 0-7393 · TWX: 213-836-0407

pulse generators / pulse systems / accurate time delay generators

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Area Code 213 Telephone 870-7393
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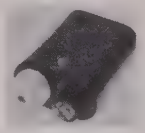
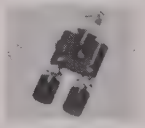
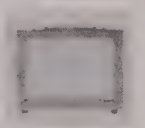
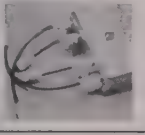
APL 10M - 163

ACCESSORY ASSEMBLIES

PRINTED IN U.S.A.
JANUARY 1963

Rutherford accessories are precisely designed to enhance greater efficiency and performance, ease of operation for use in pulse instrumentation

RT NO.	DASH NO.	NAME	DESCRIPTION	PRICE
J001	–1	Extension Cable, Coax. 185 ohms (RG 114/u) Type C Connector, Both Ends	6 in. long	$17.50
	–2		10 in. long	17.75
	–3		20 in. long	18.00
	–4		24 in. long	18.25
	–5		48 in. long	21.00
	–6		96 in. long	23.00
J002	–1	Extension Cable, Coax. 185 ohms (RG 114/u) Type C Connector, One end, Open Other End	24 in. long	14.50
	–2		48 in. long	16.00
	–3		60 in. long	17.00
	–4		96 in. long	19.00
J003	–1	Extension Cable, Coax. 50 ohms (RG 58/u) Type BNC Connector, Both Ends	12 in. long	12.50
	–2		24 in. long	13.50
	–3		48 in. long	14.50
	4		96 in. long	16.50
J004	–1	Extension Cable, Coax. 50 ohms (RG 58/u) Type BNC Connector, One End, Open Other End	12 in. long	10.00
	–2		24 in. long	11.00
	–3		48 in. long	12.50
	–4		96 in. long	14.00
J005	–1	Extension Cable, Coax. 50 ohms (RG 58/u) Type N Connector, Both Ends	24 in. long	12.00
	–2		48 in. long	14.00
	–3		96 in. long	16.00
J006	–1	Extension Cable, Coax. 50 ohms (RG 58/u) Type N Connector, One End, Open Other End	24 in. long	10.00
	–2		48 in. long	12.50
	–3		96 in. long	14.00
J007	–1	Extension Cable, Coax. 50 ohms (RG 58/u) Type UHF Connector, Both Ends	12 in. long	8.50
	–2		24 in. long	9.00
	–3		48 in. long	10.00
	–4		96 in. long	12.50
J008	–1	Extension Cable, Coax. 50 ohms (RG 58/u) Type UHF Connector, One End, Open Other End	12 in. long	7.00
	–2		24 in. long	7.75
	–3		48 in. long	9.25
	–4		96 in. long	10.00
J009	–1	Extension Cable, Coax. 93 ohms (RG 62/u) Type BNC Connector, Both Ends	12 in. long	12.00
	–2		24 in. long	13.00
	–3		48 in. long	14.00
	–4		96 in. long	16.00
J010	–1	Extension Cable, Coax. 93 ohms (RG 62/u) Type BNC Connector, One End, Open Other End	12 in. long	8.50
	–2		24 in. long	9.00
	–3		48 in. long	10.00
	–4		96 in. long	12.50

PART NO.	DASH NO	NAME	DESCRIPTION	PRICE
J011	–1	Extension Cable, Coax. 93 ohms (RG 62/u) Type UHF Connector, Both Ends	12 in. long	$ 8.50
	–2		24 in. long	9.00
	–3		48 in. long	10.00
	–4		96 in. long	12.00
J012	–1	Extension Cable, Coax. 93 ohms (RG 62/u) Type UHF Connector, One End, Open Other End	12 in. long	7.00
	–2		24 in. long	7.75
	–3		48 in. long	9.25
	–4		96 in. long	10.00
J014		Extension Cable, 16 Wire, Amphenol 26-4100-16P Plug, One End, 26-4200-16S Socket, Other End	40 in long. Extension Cable to be used with Model B3 and Model B5 Systems	20.00
J015		Extension Cable, 11 wire, Amphenol #86 PM11 Plug, One End, #78 PF11 Socket, Other End	24 in. long. Extension Cable to be used with Model B2 and B2A Pulse Generators	12.00
J017	–1	Adapter	Adapter, Banana Plug to Type BNC Coax. Connector, Non-Locking	8.50
	–2	Adapter	Adapter, Banana Plug to Type BNC Coax. Connector, Lock-on Type	17.50
	–3	Adapter	 Adapter, Banana Plug to Type UHF Coax. Connector, Lock-on Type	17.50
	– 4	BNC Binding Post Adapter	 Can be used to adapt the Single Shot Pulse Generator to the B-5A 10 MC Pulse Generator.	10.00
J018		"One-Shot" Pulse Generator	"One-Shot" Push Button Actuated Pulse Generator. Suitable for Single Pulse Operation of Model B7 Pulse Generator. 18 Volt Pulse into 470 ohms Mounts in Standard Banana Jacks	52.50
J019	–1	Air Filter End Cover	 Replaces Intake End Cover on Model B7 Pulse Generator to Prevent Excessive Dust from Entering Instrument. Filter Removable for Cleaning or Replacement	23.00
	–2	Air Filter End Cover	Same as –1, Except for Model B7B Pulse Generator	23.00
J032	–1	Mixer Assembly	"Two Input" Mixer Assembly for Model B7 or B7B. Maximum Input Power Each, Input 30 Watts Average. Impedance 50 ohms	49.50
	–2	Mixer Assembly	"Three Input" Mixer Assembly for Model B7 or B7B. Maximum Input Power Each, Input 30 Watts Average. Impedance 50 ohms	66.00
	–3	Mixer Assembly	 "Four Input" Mixer Assembly for Model B7 or B7B. Maximum Input Power Each, Input 30 Watts Average. Impedance 50 ohms	82.50

DASH NO	NAME	DESCRIPTION	PRICE
–1	Extension Cable, Coax. 93 ohms (RG 62/u) Type UHF Connector, Both Ends	12 in. long	$ 8.50
–2		24 in. long	9.00
–3		48 in. long	10.00
–4		96 in. long	12.00
–1	Extension Cable, Coax. 93 ohms (RG 62/u) Type UHF Connector, One End, Open Other End	12 in. long	7.00
–2		24 in. long	7.75
–3		48 in. long	9.25
–4		96 in. long	10.00
	Extension Cable, 16 Wire, Amphenol 26-4100-16P Plug, One End, 26-4200-16S Socket, Other End	40 in long. Extension Cable to be used with Model B3 and Model B5 Systems	20.00
	Extension Cable, 11 wire, Amphenol #86 PM11 Plug, One End, #78 PF11 Socket, Other End	24 in. long. Extension Cable to be used with Model B2 and B2A Pulse Generators	12.00
–1	Adapter	Adapter, Banana Plug to Type BNC Coax. Connector, Non-Locking	8.50
–2	Adapter	Adapter, Banana Plug to Type BNC Coax. Connector, Lock-on Type	17.50
–3	Adapter	Adapter, Banana Plug to Type UHF Coax. Connector, Lock-on Type	17.50
–4	BNC Binding Post Adapter	Can be used to adapt the Single Shot Pulse Generator to the B-5A 10 MC Pulse Generator.	10.00
	"One-Shot" Pulse Generator	"One-Shot" Push Button Actuated Pulse Generator. Suitable for Single Pulse Operation of Model B7 Pulse Generator. 18 Volt Pulse into 470 ohms Mounts in Standard Banana Jacks	52.50
–1	Air Filter End Cover	Replaces Intake End Cover on Model B7 Pulse Generator to Prevent Excessive Dust from Entering Instrument. Filter Removable for Cleaning or Replacement	23.00
–2	Air Filter End Cover	Same as –1, Except for Model B7B Pulse Generator	23.00
–1	Mixer Assembly	"Two Input" Mixer Assembly for Model B7 or B7B. Maximum Input Power Each, Input 30 Watts Average. Impedance 50 ohms	49.50
–2	Mixer Assembly	"Three Input" Mixer Assembly for Model B7 or B7B. Maximum Input Power Each, Input 30 Watts Average. Impedance 50 ohms	66.00
–3	Mixer Assembly	"Four Input" Mixer Assembly for Model B7 or B7B. Maximum Input Power Each, Input 30 Watts Average. Impedance 50 ohms	82.50

INSTRUCTION MANUALS

NOTE: Serial Numbers of Instrument Must Be Included When Reordering Instruction Manuals

PART NO.	DASH NO.	NAME	DESCRIPTION	PRICE
J020		Instruction Manual	For Model A2 or Model A4 Time Delay Generator	5.00
J021	–1*	Instruction Manual	For Model B2 Pulse Generator	7.50
	–2		For Model B2A Pulse Generator	7.50
J022*	–1	Instruction Manual	For Model B3 Pulse Generator	7.50
	–2		For Model B3-2 Pulse Generator	10.00
	–3		For Model B3-2A Pulse Generator	10.00
	–4		For Model B3-3 Pulse Generator	10.00
	–5		For Model B3-4 Pulse Generator	10.00
J023*		Instruction Manual	For Model B4 Time Measuring System	10.00
J024	–1*	Instruction Manual	For Model B5 Pulse Generator	10.00
	–2		For Model B5A Pulse Generator	10.00
	–3		For Model B5-2 Pulse Generator	10.00
J025	–1*	Instruction Manual	For Model B7 Pulse Generator	5.00
	–2		For Model B7B Pulse Generator	5.00
J026*		Instruction Manual	For Model D2 Calibrator	7.50
J027*		Instruction Manual	For Model G1 Pulse and Sq. Wave Generator	7.50
J028		Instruction Manual	For Model J018 "One-Shot" Pulse Generator	3.00
J039		Instruction Manual	For Model A9-001 Time Delay Generator	10.00
J040		Instruction Manual	For Model B9-001 Pulse Generator	10.00
J041		Instruction Manual	For Model B7D Pulse Generator	5.00
J042		Instruction Manual	For Model B7F Pulse Generator	5.00
J043		Instruction Manual	For Model B-12 High Speed Pulse Generator	5.00

*Indicates Instrument No Longer In Production, But Manuals For Existing Instruments Available

INSTRUMENT MODIFICATION

PART NO.	DASH NO.	NAME DESCRIPTION	PRICE
J029	–1	Modifies the Model B2A to Provide for External Delay and Width Modulation	115.00
	–2	Modifies the Model B2A to Provide for External Delay Modulation	65.00
J031		Modifies Model A2 or Model A4 to Incorporate Special Delay Range Per Customer Requirement	60.00
J033		Modifies Model B5 to Model B5-A	1,000.00
J034		Modifies Model B5 to Model B5-2 Double Pulse Generator	3,073.00
J035		Modifies Model B5-A to Model B5-2 Double Pulse Generator	2,080.00
J036		Delay Cable Model B5-2	325.00

THE ACCESSORIES ARE DESIGNED TO COMPLEMENT Rutherford PULSE INSTRUMENTATION

NEW MODEL B7-B HIGH REPETITION RATE PULSE GENERATOR AT LOW COST, HIGH PERFORMANCE and WIDE VERSATILITY

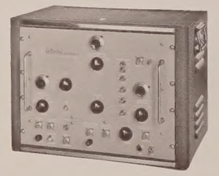
50 volts into 50 ohms at 30% duty factor... rep. rate to 2 mc... widths .05 μs to 10,000 μs... delays to 10,000 μs...

Low Budget Price... $720.00

10 MEGACYCLE PULSE GENERATOR MODEL B5-A

Featuring... high repetition rate with no greater than 8 millimicroseconds rise and fall time operating from 1 cps to 10 megacycles.

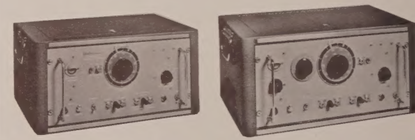
Price: $2,400.00



MODEL B2-A

A general purpose instrument which produces pulses of accurately controlled widths, amplitude and time delay at low impedance. Internal oscillator gives repetition rates from 10 cycles to 100 kc. Pulse widths from .08 μs to 1,000 μs.

Price: $1,280.00

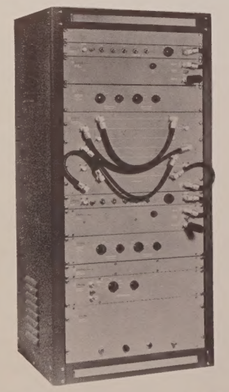


TWO TIME DELAY GENERATORS

Model A-2 **Model A-4**

Feature: Low jitter. Linear scales. Small repetition rate effects. External connector provided for delay voltage so that unit may be externally time modulated. Easily read dial controls.

Price: Model A-2 $750.00 Model A-4 $875.00



HIGH SPEED 10 MEGACYCLE DOUBLE PULSE GENERATOR MODEL B5-2

Both pulse trains are derived from one single oscillator. Its output pulses are adjustable in widths from 20 mμs to 12.5 μs with rise and fall time no greater than 8 mμs. Maximum pulse width is restricted to about 20% of the pulse to pulse spacing. (Duty cycle .20 or less). Continuously variable repetition rate, pulse width and pulse delay permit the study of high speed switching circuits.

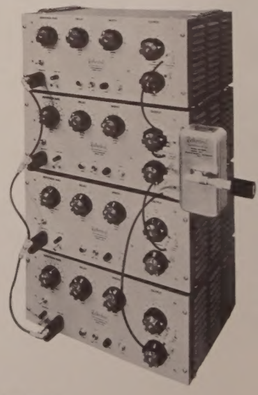
Price: $3.975.00

MULTI-PULSE Rutherford HIGH REPETITION RATE MULTI-PULSING SYSTEM at low cost!

4 MODEL B7-B with the use of a MIXING NETWORK produces 4 INDIVIDUAL PULSES of various specifications. The stacked units may be placed in a 19" rack type cabinet. Each of the four B7-B models can be disassembled and returned to laboratories for use as individual pulse generators.

Price: $720.00 each,

MIXER ASSEMBLY - $82.50



All prices F.O.B. Culver City, California

For detailed specifications on Rutherford pulse instrumentation write for complete bulletin.

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Post Office Box 472 Culver City, California Area Code 213 Telephone: 870-7393
TWX 213-836-0407

Represented in Your Area by...

THE MODEL B-7D
PULSE GENERATOR

The NEW MODEL B-7D incorporates all of the time-proven specifications of the popular MODEL B-7B . . .

PLUS THREE NEW FEATURES

- **Simultaneous Positive and Negative Output Pulses**
  The two pulses available at front panel connectors are identical in all respects except for being opposite in polarity.
- **Separate and Independent Rise and Fall Time Controls**
  The rise or fall time of either pulse may be degraded without affecting the remaining rise and fall times.
- **DC Level Control on both outputs**
  The DC level of each output may be set to zero, at all duty factors up to 30%, by front panel control.

MODEL B-7F DOUBLE PULSE GENERATOR

The NEW MODEL B-7F incorporates all of the time-proven specifications of the popular MODEL B-7B . . .

PLUS THREE NEW FEATURES

- **2 cycle/second Repetition Rate**
  Repetition rate is continuously variable from 2 cycles/second to 2 megacycles/second.
- **Separate and Independent Rise and Fall Time Controls**
  The rise or fall time of the output pulse may be independently degraded to approximately 1 μ sec.
- **Double Pulse Output**
  Either single or double pulse output available by front panel control.

Rutherford ELECTRONICS CO.

750/10/63

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